MERCURY
MerCruiser

SERVICE MANUAL

Number 37

MARINE ENGINES

DRY JOINT

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Notice

Throughout this publication, Dangers, Warnings and Cautions (accompanied by the International HAZARD Symbol ⚠) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY!**

These Safety Alerts alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus common sense operation, are major accident prevention measures.

⚠ DANGER

Immediate hazards which will result in severe personal injury or death.

⚠ WARNING

Hazards or unsafe practices which could result in severe personal injury or death.

⚠ CAUTION

Hazards or unsafe practices which could result in minor personal injury or product or property damage.

Notice to Users of This Manual

This service manual supplement has been written and published by the Service Department of Mercury Marine to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with marine product servicing procedures. Furthermore, it is assumed that they have been trained in the recommended service procedures of Mercury MerCruiser product, including the use of mechanics' common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the marine trade of all conceivable procedures and of the possible hazards and/or results of each method. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. As required, revisions to this manual will be sent to all dealers contracted by us to sell and/or service these products.

Working On The Product

It should be kept in mind, while working on the product, that the electrical system and ignition system are capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.

Replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the metric bolts and on the surfaces of metric nuts indicate their strength. American bolts use radial lines for this purpose, while most American nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possibly personal injury. Therefore, fasteners removed should be saved for reuse in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.

Engine Mechanical Components

Many of the engine mechanical components are designed for marine applications. Unlike automotive engines, marine engines are subjected to extended periods of heavy load and wide open throttle operation and, therefore, require heavy-duty components. Special marine engine parts have design and manufacturing specifications that are required to provide long life and dependable performance. Marine engine parts also must be able to resist the corrosive action of salt or brackish water that will rust or corrode standard automotive parts within a short period of time.

Failure to use recommended Mercury Marine service replacement parts can result in poor engine performance and/or durability, rapid corrosion of parts subjected to salt water and possibly complete failure of the engine.

Replacement Parts

Use of parts other than the recommended service replacement parts, will void the warranty on those parts that are damaged as a result.

⚠ WARNING

Electrical, ignition and fuel system components on Mercury MerCruiser Engines and Sterndrives are designed and manufactured to comply with U.S. Coast Guard Rules and Regulations to minimize risks of fire or explosion.

Use of replacement electrical, ignition or fuel system components, which do not comply to these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

Cleanliness And Care Of The Product

A marine power product is a combination of many machined, honed, polished, and lapped surfaces with tolerances that are measured in the ten thousands of an inch/mm. When any product component is serviced, care and cleanliness are important. Throughout this manual, it should be understood that proper cleaning and protection of machined surfaces and friction areas is a part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Personnel should not work on or under an engine that is suspended. Engines should be attached to work stands or lowered to ground as soon as possible.

Whenever components are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.

NOTES:

Models Covered in This Manual

Sterndrive (MCM) Model	Serial Number
5.0L	0M600000 Through 0M614999
5.0L	0M615000 And Above
5.0 MPI	0M600000 Through 0M614999
5.0 MPI	0M615000 And Above
5.7L	0M600000 Through 0M614999
5.7L	0M615000 And Above
350 MAG MPI	0M600000 Through 0M614999
350 MAG MPI	0M615000 And Above
350 MAG MPI Horizon	0M600000 Through 0M614999
350 MAG MPI Horizon	0M615000 And Above
MX 6.2 MPI	0M600000 Through 0M614999
MX 6.2 MPI	0M615000 And Above
MX 6.2 MPI Horizon	0M600000 Through 0M614999
MX 6.2 MPI Horizon	0M615000 And Above

Inboard And Tow Sports (MIE) Model	Serial Number
5.7L	0M317000 Through 0M389999
5.7L	0M390000 And Above
350 MAG MPI	0M317000 Through 0M389999
350 MAG MPI	0M390000 And Above
Black Scorpion	0M317000 Through 0M389999
Black Scorpion	0M390000 And Above
350 MAG MPI Horizon	0M317000 Through 0M389999
350 MAG MPI Horizon	0M390000 And Above
MX 6.2 MPI	0M317000 Through 0M389999
MX 6.2 MPI	0M390000 And Above
MX 6.2 Black Scorpion	0M317000 Through 0M389999
MX 6.2 Black Scorpion	0M390000 And Above
MX 6.2 MPI Horizon	0M317000 Through 0M389999
MX 6.2 MPI Horizon	0M390000 And Above

NOTES:

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Introduction

NOTICE
For information and procedures not listed, refer to the appropriate Mercury MerCruiser Service Manual.

NOTICE
Refer to appropriate Mercury MerCruiser Service Manual for transom assembly and sterndrive unit repair.

The following sections of supplemental information has been prepared to assist in the identification and servicing of Mercury MerCruiser MPI V-8 gasoline engines equipped with the Warm Manifolds and Dry Joint Exhaust System.

This supplement is intended to be used in conjunction with the appropriate Mercury MerCruiser service manual for the engine being serviced, and not in place of the manual. The scope of this supplement is to highlight new or different specifications, components and procedural information as they pertain to the small block V-8 engines versus previous small block V-8 engines.

An understanding of the material contained herein and in subsequent publications issued when necessary will assist service personnel in properly maintaining the Mercury MerCruiser engine and control systems at the level of quality to which they are built.

This comprehensive overhaul and repair manual is designed as a service guide for the models previously listed. It provides specific information, including procedures for disassembly, inspection, assembly, and adjustment to enable dealers and service mechanics to repair and tune these engines.

Before attempting repairs or tune-up, it is suggested that the procedure first be read through to gain knowledge of the methods and tools used and the cautions and warnings required for safety.

How to Use This Manual

This manual is divided into sections that represent major components and systems.

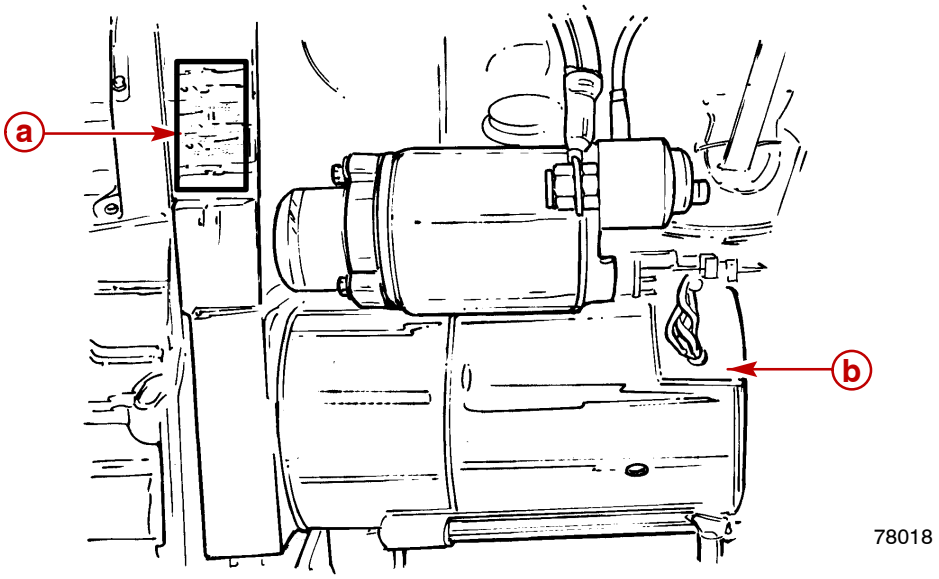
Some sections are further divided into parts that more fully describe the component.

Page Numbering

Two number groups appear at the bottom of each page. The following is an example and description.

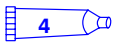
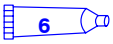
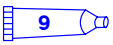
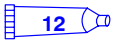
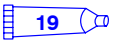
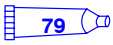
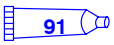
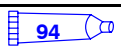
a - Section number
b - Section part
c - Page number
d - Supplement manual number
e - Month printed
f - Year printed

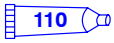
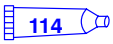
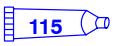
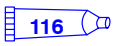
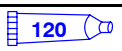
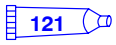
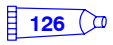
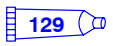
Engine Serial Number Locations

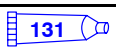
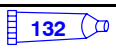
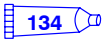
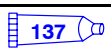
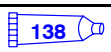
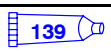
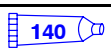
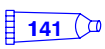
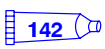
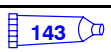
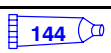


a - Serial number plate
b - Starter motor

Mercury/Quicksilver Lubricants, Sealants, and Adhesives

Tube Ref. No.	Description	Mercury Part Number	Quicksilver Part Number
	Needle Bearing Assembly Lubricant	92-802868A1	N/A
	Dielectric Grease	92-823506-1	92-823506-1
	Loctite 271	92-809819	92-809819
	Loctite 567 PST Pipe Sealant	92-809822	92-809822
	Loctite Master Gasket Kit	92-12564-2	92-12564-2
	2 Cycle Premium Outboard Oil	92-802813A1	92-802813Q1
	Perfect Seal	92-34227-1	92-34227-1
	Liquid Neoprene	92-25711-3	92-25711-3
	Bellows Adhesive	N/A	92-86166Q1
	Loctite 680 Retaining Compound	92-809833	92-809833
	Special Lubricant 101	92-802865A1	92-802865Q1
	U-joint and Gimbal Bearing Grease	92-802870A1	92-802870Q1
	Loctite 222 Thread Locker	92-809818	92-809818
	Loctite 242 Thread Locker	92-809821	92-809821
	4 Cycle 25W40 Engine Oil	92-802837A1	92-802837Q1
	Premium Gear Lubricant	92-802846A1	92-802846Q1
	High Performance Gear Lube	92-802854A1	92-802854Q1
	Engine Coupler Spline Grease	92-802869A1	92-802869Q1
	Anti-Corrosion Grease	92-802867A1	92-802867Q1

Tube Ref. No.	Description	Mercury Part Number	Quicksilver Part Number
	2-4-C with Teflon	92-802859A1	92-802859Q1
	4 Stroke 10W30 Outboard Oil	92-802833A1	92-802833Q1
	Power Trim and Steering Fluid	92-802880A1	92-802880Q1
	Premium Plus 2 Cycle TC-W3 Outboard Oil	92-802824A1	92-802824Q1
	RTV 587 Silicone Sealer	92-809825	92-809825
	Loctite 7649 Primer N	92-809824	92-809824
	Storage Seal Rust Inhibitor	92-802878-56	92-802878Q56
	Corrosion Guard	92-802878 55	92-802878Q55
	15W40 4-cycle Diesel Engine Oil	92-877695K1	92-877695Q1
	Extended Life Antifreeze/Coolant	92-877770K1	92-877770K1
	Marine Engine Coolant	NA	92-813054A2
	Fuel System Treatment and Stabilizer Concentrate	92-802876A1	92-802876Q1
	Heat Transfer Compound	92-805701 1	NA
	Liquid Gasket	92-808137	NA
	T442 Sealant	92-862258	NA
	Loctite 5900 Ultra Black RTV Silicone Sealant	92-809826	NA
	Loctite Gasket Remover	92-809828 1	NA
	Sealer Kit, Two Part Epoxy	NA	92-65150 1

Tube Ref. #	Description	Mercury Part Number	Quicksilver Part Number
	Anti-seize Compound	92-881091K1	NA
	Torco MTF Gear Oil	92-849864-1	NA
	Optimol Longtime PD 2	92-848767	NA
	Dexron III Automatic Transmission Fluid	Obtain Locally	Obtain locally
	Loctite 592	Obtain Locally	Obtain locally
	Loctite Quick Tite	Obtain Locally	Obtain locally
	Isopropyl Alcohol	Obtain Locally	Obtain locally
	Hot Glue	Obtain Locally	Obtain locally
	Loctite 609	Obtain Locally	Obtain locally
	Loctite 405	Obtain Locally	Obtain locally
	Cyanacrylate Adhesive	Obtain Locally	Obtain locally
	3M Permabond 3M08155	Obtain Locally	Obtain locally
	Loctite 262	Obtain Locally	Obtain locally
	Loctite 290	Obtain Locally	Obtain locally

COOLING SYSTEM

Section 6A - Cooling System All Models

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6 A

Torque Specifications

NOTE: *Securely tighten all fasteners not listed below.*

Description	Nm	lb-in.	lb-ft
Seawater pickup nut	48		35
Seawater pump cover to housing bolt	9.9	88	
Seawater pump bracket-to-engine bolt	41		30
Water pump fastener	48		35
Water distribution housing bracket fasteners	38		28
Water distribution housing to bracket screws	13.5	120	

Lubricants / Sealants / Adhesives

Description	Where Used	Part Number
Loctite 271	Seawater pickup fasteners	92-809819
Marine caulk	Boat hull and seawater pickup joints	Obtain locally
Loctite 567 PST Pipe Sealant	Transom mounted seawater pickup fitting and plastic plug	92-809822
Silicone sealant or equivalent	Transom mounted seawater pickup screws	Obtain locally
Engine oil	Seawater pump bearing shaft	Obtain locally
Loctite 609	Seawater pump retainer/seal	Obtain locally
Perfect Seal	Water circulating pump gaskets and fasteners	92-34227-1
Loctite 242 Thread Locker	Seawater pump cover to housing bolt	92-809821
Loctite 565 PST	Hose fitting threads, Plastic plug threads	Obtain locally

Seawater Inlet Recommendations

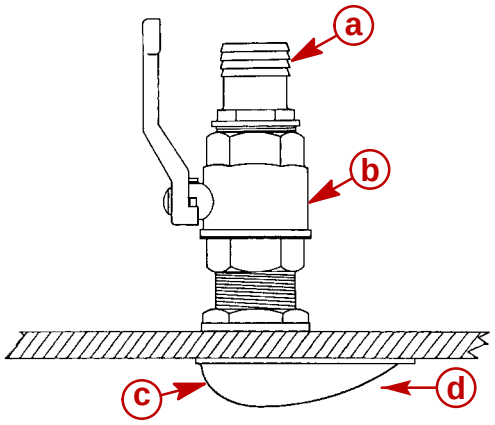
Specifications

Description	Specification
Minimum flow (closed cooled models)	114 liters per minute (30 gallons per minute) at 4000 rpm
Minimum pressure (closed cooled models)	20 psi (138 kPa) at 4000 rpm
Water pickup	32 mm (1-1/4 in.) ID wire reinforced
Water inlet hose	32 mm (1-1/4 in.) connections
Seacock	
Sea strainer	

Seacock (Seawater Inlet Valve)

The seacock used must have an internal cross-sectional area equal to or greater than seawater inlet hose to prevent restricting water flow. Install valve in an area where it will be easily accessible and supported adequately to prevent hose fatigue. A brass ball or gate valve is required. Select a proper seacock based on the following chart:

Seacock Size (Internal Cross-Sectional Area Equal to or Greater Than Size Shown)	
Gasoline engines	32 mm (1-1/4 in.)



70355

Seacock

- **a** - Hose connector 32 mm (1-1/4 in.) I.D. to seawater pump inlet
- **b** - Seacock 32 mm (1-1/4 in.) brass ball or gate valve
- **c** - Through the hull seawater pickup
- **d** - Direction of seawater flow

Sea Strainer

Strainer used must be of sufficient size to ensure that an adequate supply of water will be maintained for cooling the engine. Select a proper seawater strainer based on the following chart:

Seawater Strainer Minimum Flow Rate	
Gasoline engines	114 liters per minute (30 gallons per minute)

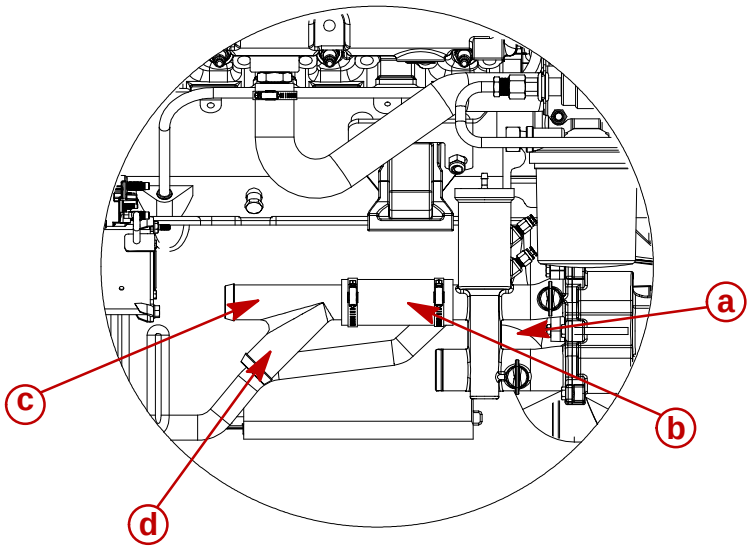
Install seawater strainer in an area where it will be easily accessible for inspection and cleaning. Strainer should be installed in water inlet hose after the seacock (water inlet valve) to allow operator to shut off water when cleaning strainer.

Y-Fitting

IMPORTANT: Bravo closed cooled models may require a through the hull or through the transom pickup in addition to the sterndrive water inlets in order to meet the minimum flow specifications.

When additional water inlets are used, a y-fitting is installed to the engine seawater pump.

1. Install the hose on the engine seawater pump inlet port.
2. Install the y-fitting on the hose.
3. Secure the hose and the y-fitting with hose clamps.



78905

a - Engine seawater pump
b - Hose from seawater pump inlet port to y-fitting
c - Y- fitting port to Bravo drive
d - Y-fitting port to additional water inlet

4. Install the water inlet hoses to the water inlet and the sterndrive.

Seawater Pickup

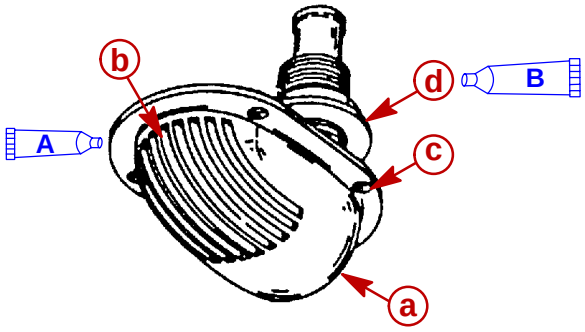
IMPORTANT: A seacock must be installed when using a through the hull or through the transom water inlet.

Through the Hull Mounted

1. Seal inside edges of 44 mm (1-3/4 in.) hole in hull using a suitable sealant.
2. Apply sealant to mounting surface on seawater pickup where hull contact will occur when installed.

Description	Where Used	Part Number
Marine caulk	Mounting surfaces	Obtain locally

3. Ensure slots in seawater pickup are facing forward (toward bow of boat) and install seawater pickup through hull.
4. Fasten pickup with 4 appropriate mounting screws (if so designed).
5. Apply marine caulking as needed inside boat. Apply sealant to threads of nut and install on pickup on inside of boat and torque nut.



72639

a - Seawater pickup
b - Seawater inlet slots
c - Mounting screw holes (if equipped)
d - Nut

Description		Where Used	Part Number
A	Marine caulk	Mounting surfaces	Obtain locally
B	Loctite 271	Seawater inlet nut	92-809820

Description	Nm	lb-in.	lb-ft
Nut	48		35

NOTE: *If pickup being installed does not have mounting screws on underside where mounted to hull, ensure that after nut is torqued slots are still facing forward.*

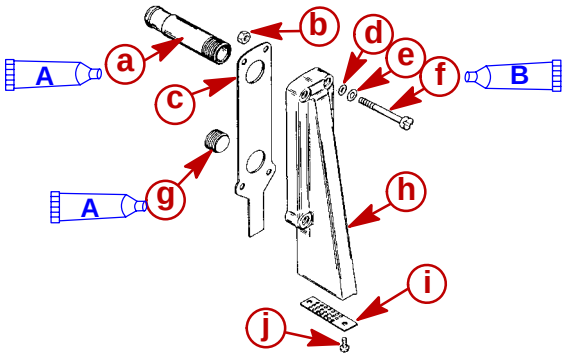
6. Install a sea strainer and a seacock into the water inlet hose.
7. After engine installation,connect the seawater inlet hose from the seawater pickup to the Y-fitting or to the seawater pump inlet fitting, depending upon the model and equipment.

Transom Mounted

1. Seal the inside edges of the 38 mm (1-1/2 in.) hole hose fitting.
2. Ensure that the hose fitting and plastic plug are in place and threads have been sealed prior to tightening each securely.

NOTE: *Use a sharp knife or wood chisel to remove excess plastic plug material so that plug is flush with pickup casting.*

3. Position 1 flat washer and 1 rubber O-ring on each 5/16 in. x 102 mm (4 in.) long, round head screw. Coat each screw shaft with sealant.
4. Place new gasket on pickup housing and hold pickup in place on transom. Install 4 round head screws (with washers and O-rings in place) into pickup mounting holes and through drilled 8 mm (21/64 in.) holes in transom.

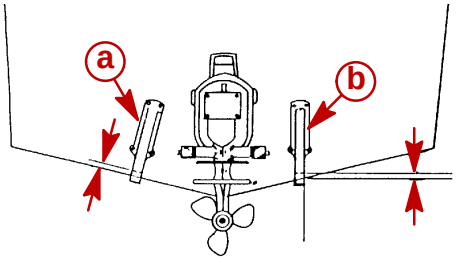


72640

a - Hose fitting
b - Nut (4)
c - Gasket
d - O-ring (4)
e - Washer (4)
f - Screw (4)
g - Plastic Pug
h - Pickup
i - Screen
j - Screw (2)

Description		Where Used	Part Number
A	Loctite 565 PST	Hose fitting threads	Obtain locally
		Plastic plug threads	
B	Silicone sealant or equivalent	Screw shaft	

NOTE: *Some installations may have 5 mm (7/32 in.) holes drilled in transom using four 5/16 in. diameter stainless steel lag bolts in place of round head screws. In any case, flat washers and O-rings are required as outlined.*



72641

Water Pickup Installed on Transom

a - Diagonal mount - leading edge of pickup 3.2 mm (1/8 in.) from boat bottom.
b - Vertical mount - corner of leading edge of pickup 3.2 mm (1/8 in.) from boat bottom

5. Secure water pickup from inside with locknuts and washers (unless using lag bolts).
6. Tighten fasteners securely.
7. Install a sea strainer and a seacock into the water inlet hose.
8. After engine installation, connect the seawater inlet hose from the seawater pickup to the Y-fitting or to the seawater pump inlet fitting, depending upon the model and equipment.

Seawater Pressure Test

IMPORTANT: The boat should be in the water for this test.

1. Connect an appropriate scan tool to the ALDL connector.
2. Ensure the remote control is in the IDLE position.
3. Start the engine and advance the the throttle to 4,000 rpm.
4. Measure the seawater pressure. If seawater pressure does not meet specification, plumbing changes will have to be made.

Description	Specification
Minimum pressure (closed cooled models)	20 psi (138 kPa) at 4000 rpm

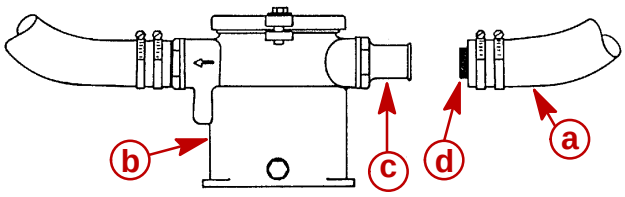
Quicksilver Sea Strainer

NOTICE
Refer to the manufacturer's instructions for information on other than Quicksilver Sea Strainer.

Removal

⚠ CAUTION
If the boat is in the water while working on the seawater strainer, close the seacock, if equipped. If the boat is not equipped with a seacock, remove and plug the seawater inlet hose to prevent a siphoning action that may occur, allowing the seawater to flow from the drain holes or removed hoses and enter the boat.

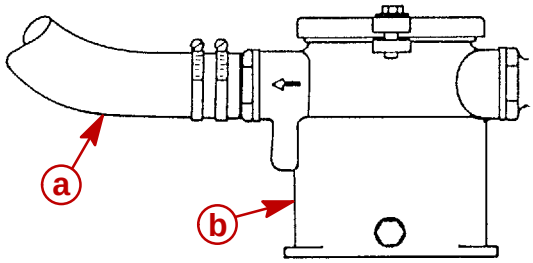
1. **Models equipped with seacock:**
   a. Close the seacock (water inlet valve).
   b. Disconnect the seawater inlet hose from the seawater strainer.
2. **Models without seacock:**
   a. Disconnect the seawater inlet hose from the seawater strainer inlet and plug the seawater inlet hose.



70062

a - Seawater inlet hose
b - Seawater strainer
c - Seawater strainer inlet
d - Plug

3. Remove the outlet hose. Drain into a suitable container.



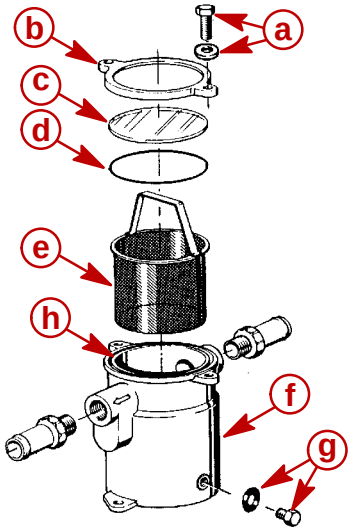
72643

a - Seawater inlet hose
b - Seawater strainer

4. Remove the mounting bolts. Remove the strainer.

Cleaning and Inspection

1. Remove and clean the filter element.
2. Remove the drain plug.



72673

Typical Quicksilver seawater strainer shown

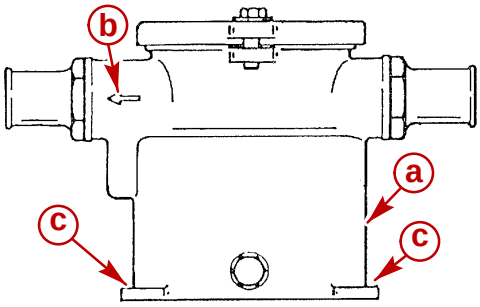
- **a** - Screws and washers
- **b** - Cover
- **c** - Glass
- **d** - O-Ring
- **e** - Strainer
- **f** - Housing
- **g** - Drain plug and sealing washer
- **h** - Gasket

3. Flush the components with clean water.

Installation

IMPORTANT: Mount the seawater strainer in a vibration-free location. Never mount it on the engine or the transmission. Hoses must not be kinked or allowed to come in contact with hot or moving engine or transmission parts.

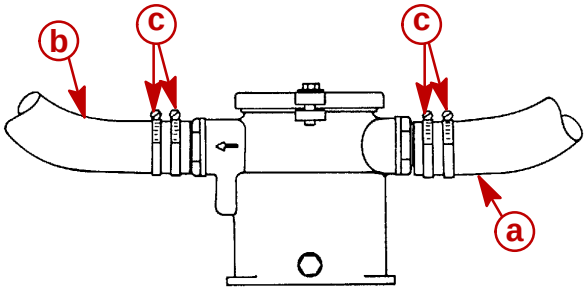
1. Mount the seawater strainer. The arrow indicates the required water flow direction and must point toward the seawater pump. Tighten the mounting bolts securely.



72644

a - Seawater strainer
b - Arrow
c - Mounting bolt hole location (bolts not shown)

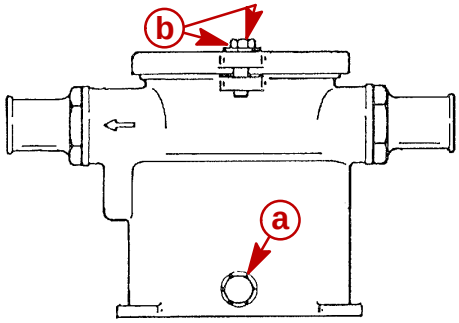
2. Remove the plug from the seawater inlet hose (if installed previously) and install the hose on the strainer. Install the seawater outlet hose. Use two hose clamps on each hose connection. Tighten the clamps securely.



72645

a - Seawater inlet hose
b - Seawater outlet hose
c - Double hose clamps

3. Check the drain plug and the lens cover bolts. Tighten securely. Do not overtighten the cover bolts or the cover may warp and leak water into the boat.

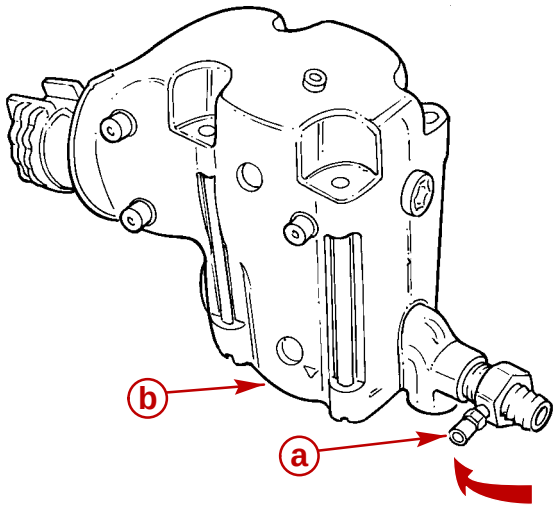


72644

a - Drain plug
b - Lens cover bolts (2, one not shown in this view)

4. Open the seacock, if equipped.

Shaft Log Seal



78776

Water tap location

a - Port exhaust elbow
b - Shaft log seal fitting at 8 o'clock position

Auxiliary Hot Water Heater Installation

IMPORTANT: When connecting a cabin heater or a hot water heater, certain requirements must be met:

- **The supply hose (from the engine to the heater) and the return hose (from the heater to the engine) MUST NOT EXCEED 16 mm (5/8 in.) I.D. (inside diameter).**
- **Make the heater connections ONLY at the locations described in the following instructions.**
- **Check the complete system for leaks after the heater is connected into the cooling system.**
- **Check for overheating condition (of the engine) after the heater is connected.**

⚠CAUTION

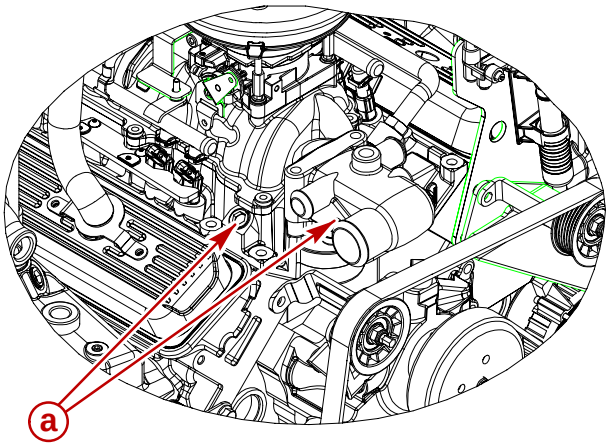
Avoid a performance loss and/or possible engine damage. Engine coolant must flow continuously from the engine intake manifold to the engine water circulating pump. NEVER close off or block the coolant flow to or from a heater.

⚠CAUTION

Avoid engine overheating which could result in engine damage. On models equipped with Closed Cooling, an air pocket may form in the closed cooling system if some coolant is lost from the system and the cabin heater or hot water heater is mounted higher than the fill cap on the heat exchanger. Heater must be mounted lower than the fill cap of the heat exchanger on models so equipped.

Supply Hose Connection

NOTE: *Some models may be equipped with additional fittings.*



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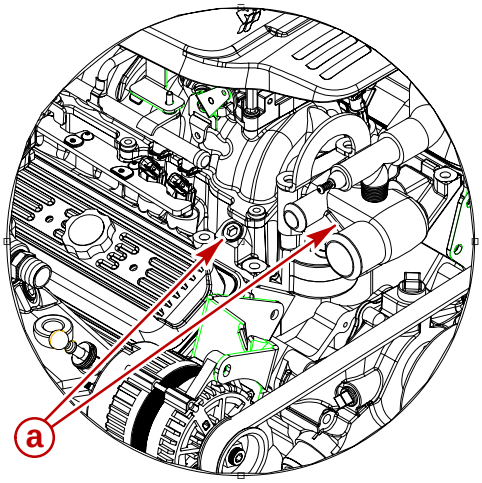
Seawater cooled models with air or manual drain

a - Supply hose connection locations



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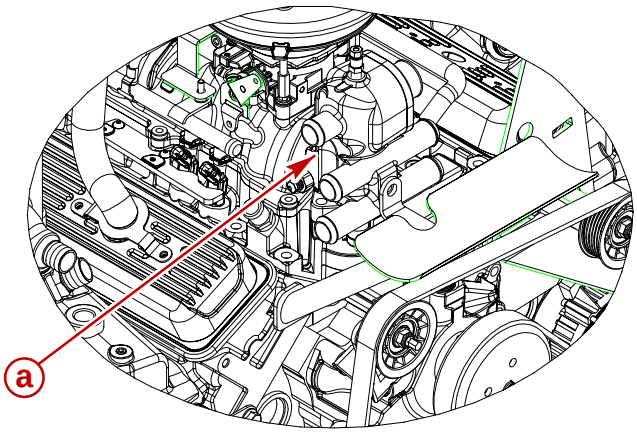
Seawater cooled models with multi-point drain

a - Supply hose connection locations



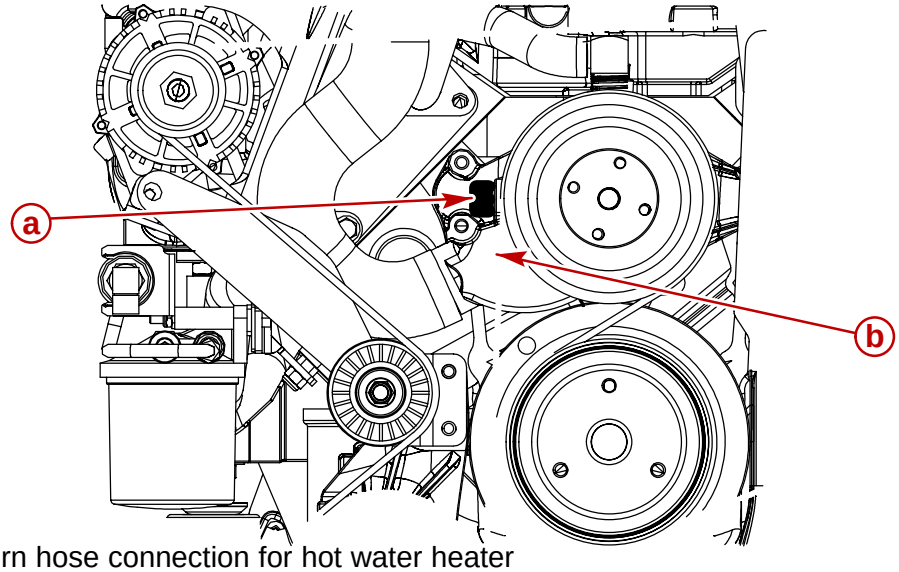
78691

Closed cooled models

a - Supply hose connection locations

Return Hose Connection

The hot water return is located on the water circulating pump housing.



a - Return hose connection for hot water heater
b - Water circulating pump housing

Seawater Pump

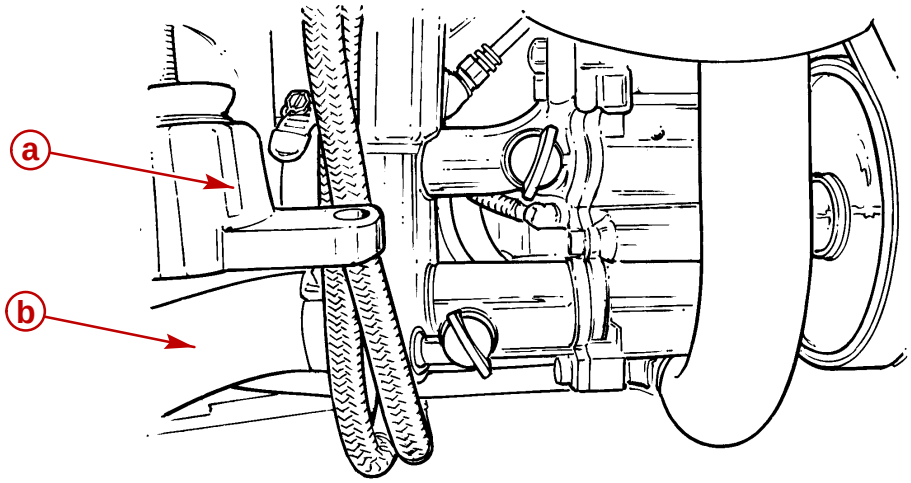
Output Test

If an overheating problem exists, use this test to determine if a sufficient amount of water is being supplied to cool the engine.

IMPORTANT: The following information should be observed before proceeding with the test:

- **THE BOAT MUST BE IN THE WATER FOR THIS TEST. This test CANNOT BE performed with a flush-test device and water hose.**
- **The ability of this test to detect a problem is greatly dependent upon the accuracy with which it is performed. An error in setting the engine rpm, timing the test or measuring the water output will affect the overall accuracy of the test and may produce misleading results. To help ensure accurate results, a shop tachometer with an error of less than 5 percent should be used. The boat tachometer definitely should not be used as it may not have the necessary precision. A stop watch should be used to time the duration of the test to help ensure that the accuracy is maintained within one second. A 9.5 Liter (10 U.S. qt.) or larger capacity container should be used to measure the water output.**
- **Due to the manner in which this test is performed, it may not be possible to detect a marginal condition or a high-speed water pump output problem.**

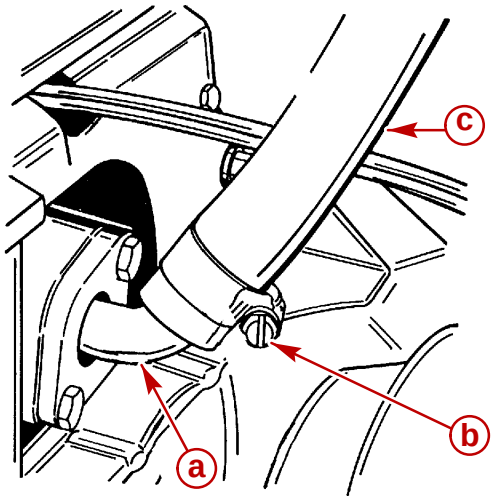
1. **Models With Engine Mounted Seawater Pump -** Remove the water hose that is between the pump outlet and the engine, and replace with another hose of the same diameter, but approximately 1 m (3 ft.) longer. The hose should be of adequate wall thickness to prevent it from kinking when performing the test. Clamp the hose at the pump outlet only. Do not clamp the hose at the engine cooler end.



77908

a - Seawater inlet hose
b - Seawater outlet hose to cooler

2. **Models With Sterndrive (Alpha) Mounted Seawater Pump -** Remove the water inlet hose, which is between the gimbal housing water tube and the engine, and replace with another hose of the same diameter, but approximately 1 m (3 ft.) longer. The hose should be of adequate wall thickness to prevent it from kinking when performing the test. Clamp the hose at the gimbal housing water tube only. Do not clamp the hose at the engine end.



72614

a - Water tube
b - Hose clamp
c - Water hose

3. Place a 9.5 Liter (10 U.S. qt.) or larger container near the unclamped end of the hose.
4. With the assistance of another person, start the engine and adjust the speed to exactly 1000 rpm while holding the unclamped end of the hose on the connection on the engine. Remove the hose from the connection on the engine and direct the water flow into the container for exactly 15 seconds. At the end of 15 seconds, direct the water flow overboard, return the engine to idle and stop the engine. Reconnect the hose to the engine.
5. Measure the quantity of water discharged into the container and compare with the specifications given in the following chart.
6. Repeat the test four times to check the repeatability of the results.

Engine Mounted Seawater Pump Output For A 15 Second Period	
Drive Unit	**Minimum Quantity Liter (U.S. Qt.)**
Bravo with seawater cooled engine	7.6 (8.0)
Bravo with closed cooled engine	9.5 (10)
All inboard and tow sport models	9.5 (10)

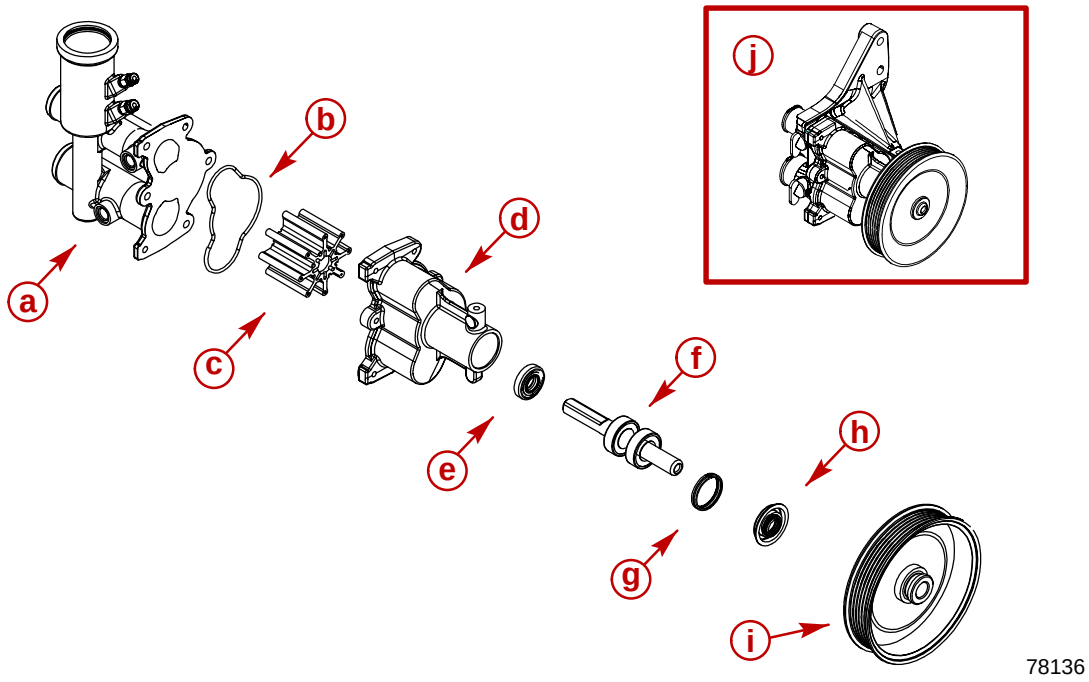
Alpha Sterndrive Seawater Pump Output For A 15 Second Period	
Drive Unit Gear Ratio	**Minimum Quantity Liter (U.S. Qt.)**
2.40:1	1.3 (1.4)
2.00:1	1.6 (1.7)
1.81:1	1.4 (1.5)
1.62:1	1.6 (1.7)
1.47:1	1.8 (1.9)

Removal

1. Drain the seawater section of the cooling system.
2. Remove both of the hoses from the aft side of the seawater pump.
3. Remove the serpentine belt.
4. Remove the two bolts attaching the seawater pump and bracket to the engine.

Disassembly

1. Press off the pulley.
2. Remove the six bolts from the rear of the seawater pump.
3. Remove and discard the O-ring.
4. Remove the impeller.
5. Remove the retainer/seal from the front of the seawater pump.
6. Remove the tolerance ring.
7. From the impeller side, press the bearing shaft out of the housing.
8. Remove the rear oil seal from the housing.



78136

a - Seawater pump back plate (single point drain system)
b - O-ring
c - Impeller
d - Seawater pump bearing housing
e - Rear oil seal
f - Bearing shaft assembly
g - Tolerance ring
h - Retainer/Seal
i - Pulley
j - Seawater pump assembly with bracket (multi point drain systems)

Cleaning and Inspection

1. Clean the metal parts in solvent and dry with compressed air.

IMPORTANT: Do not spin the bearings at high speed when drying with compressed air, as the bearings may be scored.

2. After cleaning, lightly coat the shaft and the bearings with lubricant to prevent rust.

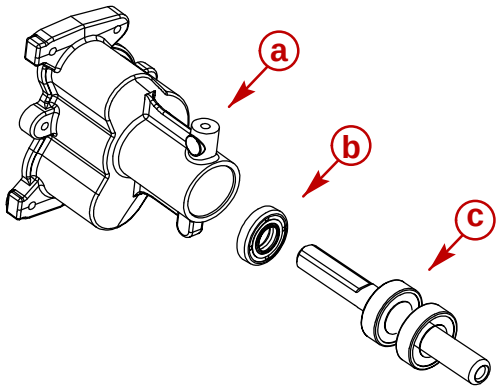
Description	Where Used	Part Number
Engine oil	Seawater pump bearing shaft	Obtain locally

3. Clean all gasket material and sealant from the sealing surfaces.
4. Inspect the bearing housing. Examine the surfaces (where the bearings contact the housing) for evidence of the bearing outer races turning in the housing.
5. Inspect the seals in the bearing housing.
6. Inspect the pump body.
7. Inspect the pump impeller for wear on the sides and the tips of the blades. Also inspect the blades for cracks in the area where the blades flex. Replace the impeller if the blades have taken a set (remain in curved position).
8. Inspect the pump pulley.
9. Inspect the serpentine drive belt for excessive wear.

Reassembly

1. Place the rear oil seal into the bearing shaft housing with the side with the spring towards the impeller cavity.
2. Lubricate the bearing shaft assembly.

Description	Where Used	Part Number
Engine oil	Seawater pump bearing shaft	Obtain locally



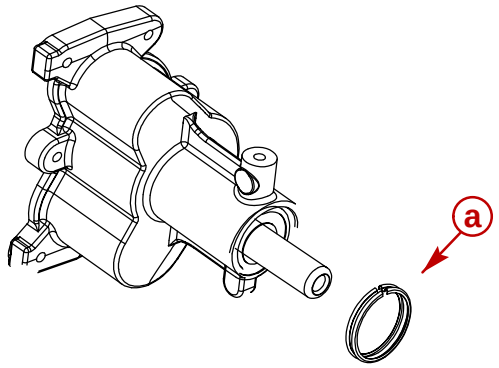
78137

a - Seawater pump bearing housing
b - Rear oil seal
c - Bearing shaft assembly

NOTE: *The bearing shaft assembly into the seawater pump bearing housing is a slip fit and only requires light force to install.*

3. Install the bearing shaft assembly into the housing.

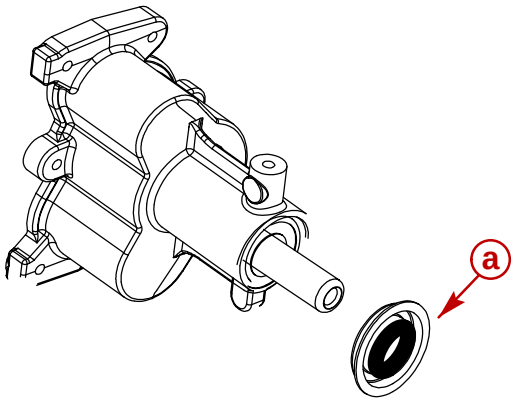
4. Install the tolerance ring.



78138

a - Tolerance ring

5. Apply adhesive to the retainer/seal outer edges. Do not apply adhesive to the seal portion of the retainer.
6. Place retainer/seal on the shaft and press it into place.



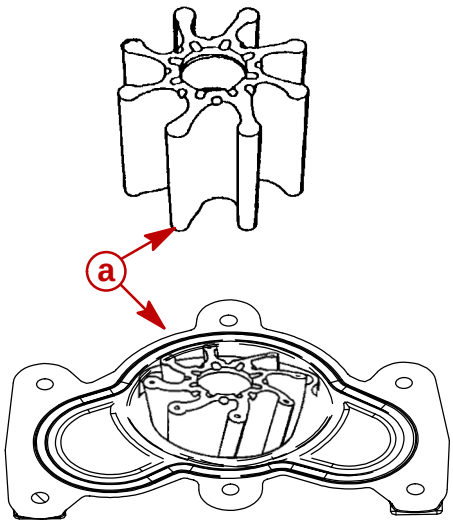
78139

a - Retainer/Seal

Description	Where Used	Part Number
Loctite 609	Seawater pump retainer/seal	Obtain locally

7. Wipe away excess adhesive.

8. Lubricate the impeller with soapy water.
9. Install the impeller into the pump body.

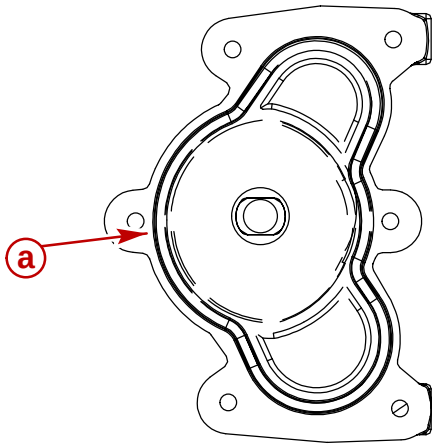


71118

71150

a - Impeller

10. Install the O-ring into the groove on the pump body.



78140

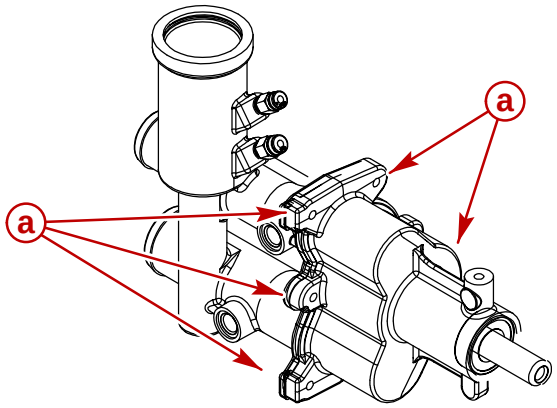
a - O-ring groove

11. Align pump body with the back plate.

12. Apply sealant to seawater pump bolt threads.

Description	Where Used	Part Number
Loctite 242 Thread Locker	Seawater pump cover to housing bolt	92-809821

13. Install bolts and torque.



78141

a - Seawater pump bolts

Description	Nm	lb-in.	lb-ft
Seawater pump bolt	9.9	88	

Installation

1. Fasten the seawater pump and bracket to the engine. Torque the bolts.

Description	Nm	lb-in.	lb-ft
Seawater pump bracket to engine bolt	41		30

2. Attach the hoses to the aft side of the seawater pump. Tighten the hose clamps securely.

NOTE: *Do not use a press to install the seawater pump pulley because it will damage the bearings.*

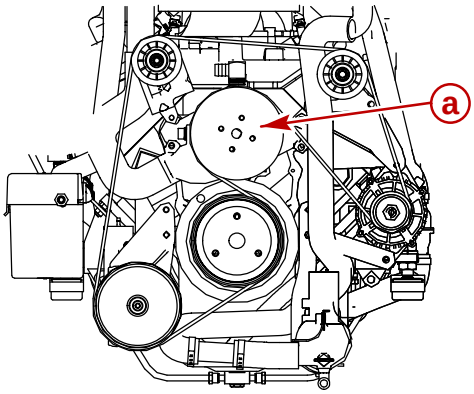
3. Press the pulley onto the seawater pump shaft using a screw with a flat washer as a pressing tool assembly. The washer should be larger than the pulley's ID.
   a. Align seawater pump pulley to the seawater pump shaft.
   b. Engage the screw assembly into the threaded ID of shaft.
   c. Further engage the screw to force pulley onto shaft.
4. Install the serpentine belt.

Water Circulating Pump

Removal

NOTE: *The water circulating pump pulley on the closed cooled models is a new design and cannot be replaced with previous Mercury MerCruiser water circulating pump pulley.*

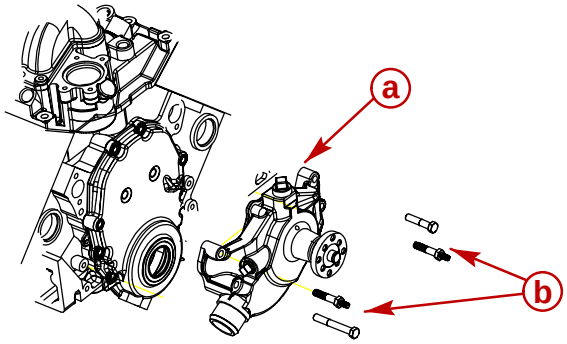
1. Allow engine to cool.
2. Drain the seawater and closed cooling (if equipped) sections of the engine.
3. Remove the hoses attached to the water circulating pump.
4. While holding the water circulating pump pulley in place, loosen the pulley bolts.
5. Remove serpentine belt.
6. Remove water circulating pump bolts and pulley.



77954

a - Water circulating pump pulley

7. Remove the fasteners and the water circulating pump.



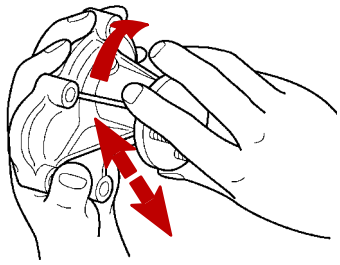
77954

a - Water circulating pump
b - Fasteners

8. Remove and discard the old gaskets.

Cleaning and Inspection

1. Clean sealing surfaces and remove sealant residue.
2. Check bearing for excessive radial play.
3. Check bearing for abnormal noise when turning the shaft.



77294

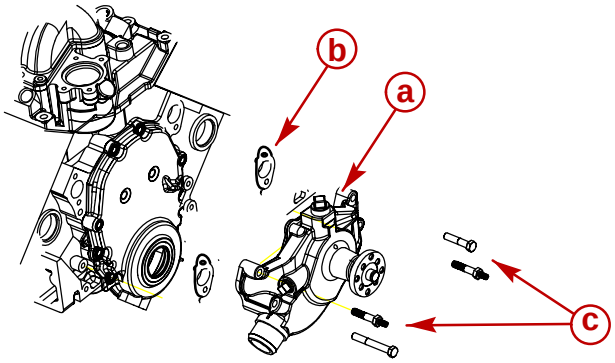
4. Check pump body for cracks.
5. Check seal for signs of leaking.
6. Check pump impeller for cracks, corrosion, or damage.

Installation

1. Coat both sides of the new water circulating pump gaskets and the threads of the attaching fasteners with sealant.

Description	Where Used	Part Number
Perfect Seal	Water pump fastener	92-34227-1

2. Install new water circulating pump gaskets to the cylinder block.
3. Install the water circulating pump. Torque the bolts.



77954

a - Water circulating pump
b - Gaskets
c - Fasteners

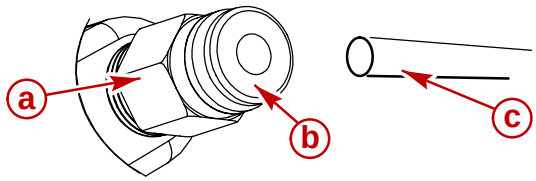
Description	Nm	lb-in.	lb-ft
Water pump fasteners	48		35

4. Install the water circulating pump pulley to the water circulating pump. Tighten the bolts securely.
5. Reconnect the hoses to the water circulating pump.
6. Install the serpentine drive belt and adjust the belt tension.
7. Fill the closed cooling system, if equipped.
8. Supply cooling water to the engine.
9. Start the engine and check for leaks.

Water Distribution Housing

Removal

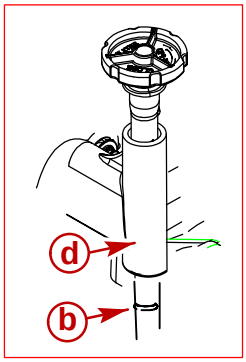
1. Drain the seawater section of the cooling system.
2. **On air actuated single point drain only:** Remove each air line from the water distribution housing by pressing on the fitting release location and pulling the line out.



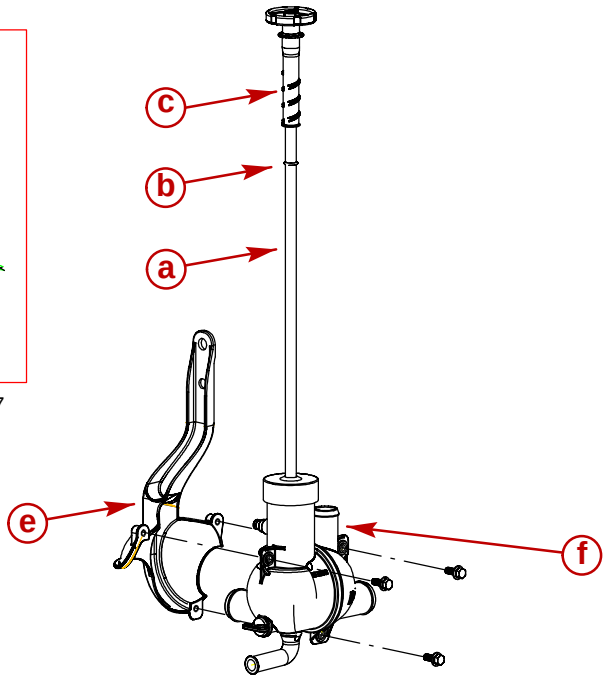
78920

a - Air line fitting
b - Release location
c - Air line

3. **On manual single point drain only:** Remove the drain rod from the water distribution housing.
   a. Remove the c-clip from the drain rod. Retain the c-clip.
   b. Turn the drain rod handle counter clockwise until the drain rod threads clear the alignment bracket. Pull the drain rod straight up to completely remove.



77947



78916

a - Drain rod with blue handle
b - C-clip
c - Drain rod threads
d - Drain rod alignment bracket
e - Bracket for the water distribution housing
f - Water distribution housing assembly

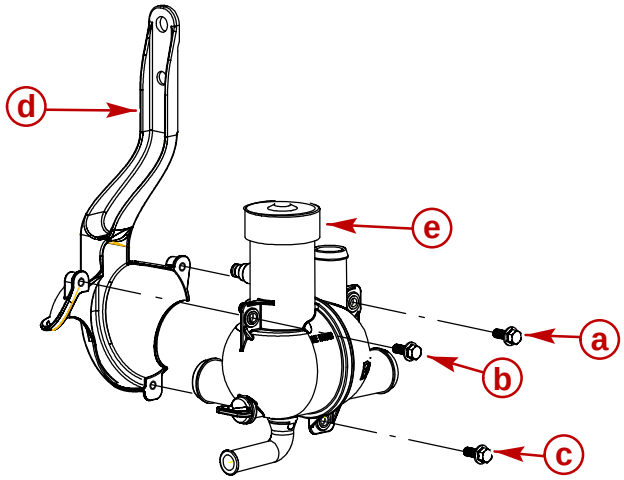
4. Disconnect the hoses from the water distribution housing.
5. Remove the bolt and nut attaching the water distribution housing and bracket to the engine.
6. Remove the bracket from the the water distribution housing.

Cleaning And Inspection

1. Clean the water distribution housing with water and dry with a clean cloth or compressed air.
2. Inspect the housing for leaks, cracks, or corrosion damage. Replace, if necessary.

Installation

1. Align the water distribution housing with the bracket.
2. Install and tighten the screws in the order listed.
   a. Top right hand side screw.
   b. Top left hand side screw.
   c. Bottom side screw.
3. Torque the screws in the same order.



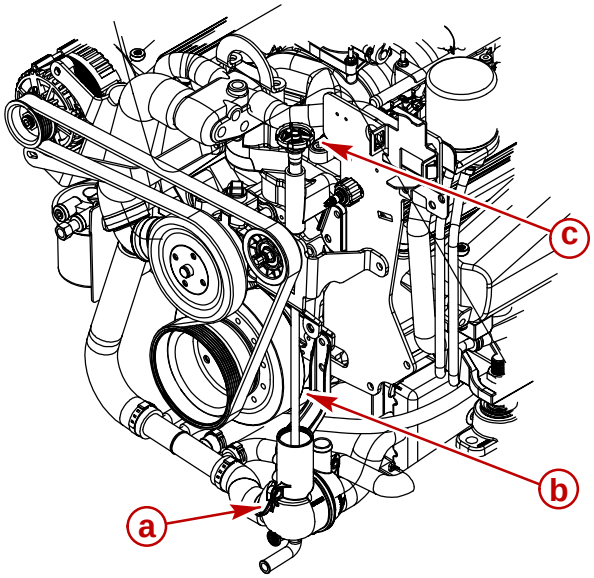
78916

a - Top right hand side screw
b - Top left hand side screw
c - Bottom side screw
d - Bracket for the water distribution housing
e - Water distribution housing assembly

Description	Nm	lb-in.	lb-ft
Water distribution housing-to-bracket screws	13.5	120	

4. Install the bracket and water distribution housing to the engine. Finger-tighten the bolt and nut.

5. **On Manual Single Point Drain only:**
   a. To obtain correct alignment, leave the hoses disconnected from the water distribution housing during installation.
   b. Position the water distribution housing assembly to align with drain rod.
   c. Engage the drain rod into the water distribution housing to complete alignment.
   d. Ensure the that the rod is correctly aligned. The rod must screw in and out of the water distribution housing easily and with little pressure.
   e. Install c-clip to drain rod.



77932

a - Water distribution housing
b - Drain rod
c - Drain rod handle

6. Torque the bolt and nut attaching the water distribution housing bracket to the engine.

Description	Nm	lb-in.	lb-ft
Water distribution housing bracket fasteners	38		28

7. **On air actuated single point drain only:** Install the air lines to the air manifold by inserting the line into the fitting until a positive stop is encountered.
8. Reconnect the hoses to the water distribution housing. Tighten the hose clamps securely.

COOLING SYSTEM

Section 6B - Seawater Cooled Models

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6 B

Torque Specifications

Models With Multi-Point Drain Systems

Description	Nm	lb-in.	lb-ft
Thermostat housing to intake screws	41		30

Models With Single Point And Manual Three Point Drain Systems

Description	Nm	lb-in.	lb-ft
Thermostat housing to intake screws	33		24

Specifications

Seawater Cooling System Capacity

Engine	Liter (U.S. Quart)
Seawater cooled models	20 (21)

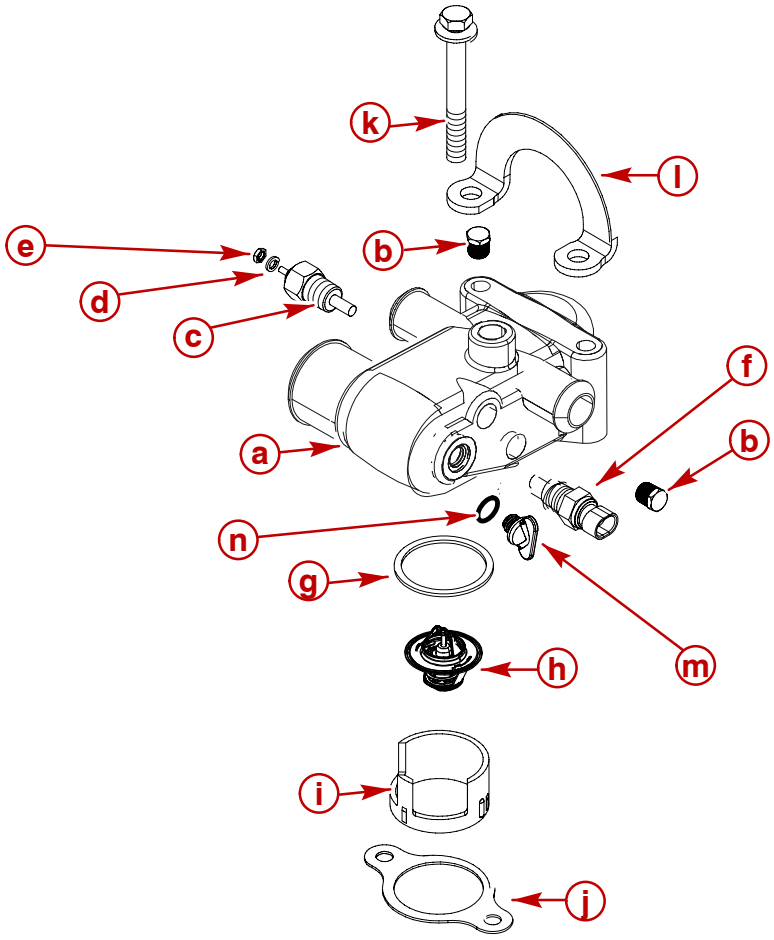
Thermostat

Engine	Specification
Seawater cooled models	71 Degrees C (160 Degrees F)

Exploded View

Thermostat Assembly

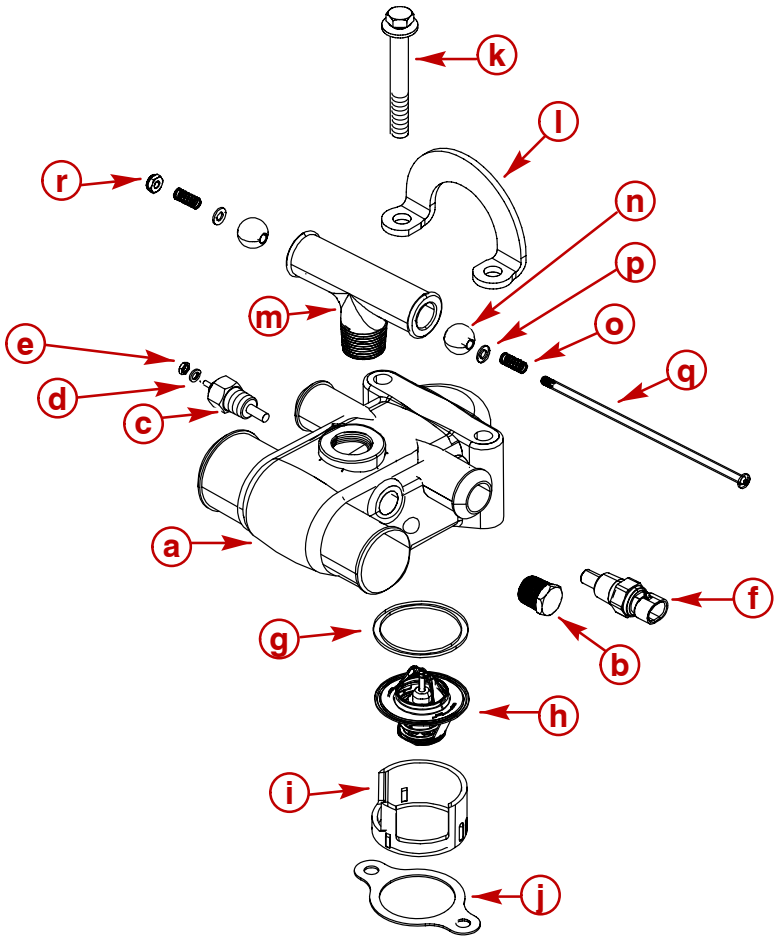
SINGLE POINT AND MANUAL THREE POINT DRAIN SYSTEMS



78907

a - Thermostat housing
b - Pipe plug (2)
c - Water temperature sender
d - Lockwasher
e - Nut
f - Temperature sensor
g - Thermostat gasket
h - Thermostat
i - Thermostat sleeve
j - Thermostat housing gasket to intake
k - Screw (2)
l - Lifting eye
m - Air vent plug (for use when draining seawater)
n - O-ring

MULTI-POINT DRAIN SYSTEM

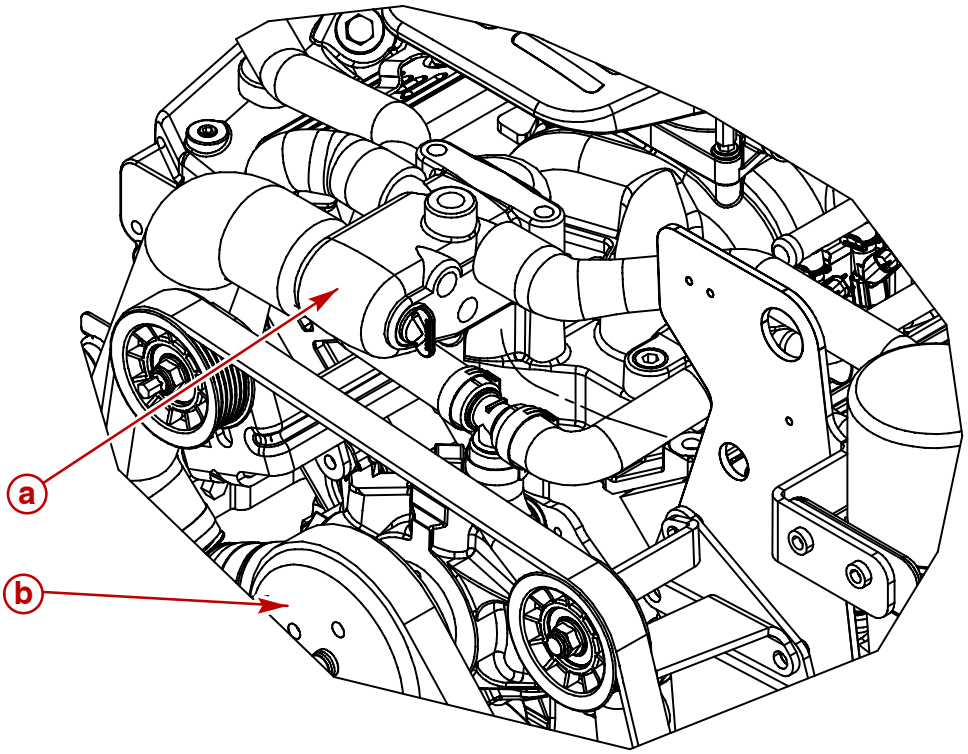


a - Thermostat housing
b - Plug, pipe
c - Water temperature sender
d - Lockwasher
e - Nut
f - Temperature sensor
g - Thermostat gasket
h - Thermostat
i - Thermostat sleeve
j - Thermostat housing gasket to intake
k - Screw (2)
l - Lifting eye
m - Tee-fitting
n - Check ball (2)
o - Spring (2)
p - Washer (2)
q - Screw
r - Locknut

Thermostat

Removal

1. Drain the seawater from the engine.
2. Remove the hoses from the thermostat housing.
3. Remove the thermostat housing assembly.
4. Remove the sleeve, thermostat, and gasket from the thermostat housing.

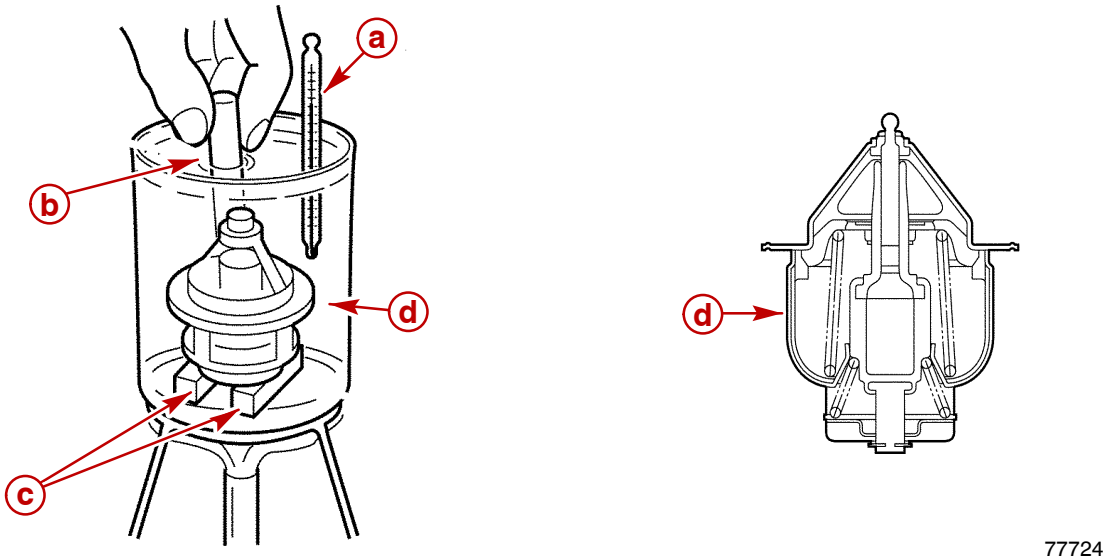


Typical thermostat housing assembly, all models similar

a - Thermostat assembly (lifting eye bracket not shown)
b - Engine water circulating pump

Testing

1. Remove the thermostat.
2. Place the thermostat on blocks in a container.
3. Completely submerge the thermostat in water.
4. Heat the water.
5. Stir the water constantly to avoid direct heat being applied to the thermostat.
6. Refer to Specifications:
   a. Check the thermostat initial opening temperature.
   b. Check the thermostat full opening temperature.
   c. Check valve lift at fully open position.



Typical thermostat

- **a** - Thermometer
- **b** - Agitating Rod
- **c** - Wooden Blocks
- **d** - Thermostat

7. Replace if specifications are not met or damage is discovered during inspection.

Installation

NOTE: *Refer to exploded view preceding for parts identification during assembly.*

1. Clean the gasket surfaces inside the thermostat housing, on the thermostat housing, and on the intake manifold.
2. Place a new thermostat gasket in the thermostat housing. Ensure that it is positioned properly in the housing.
3. Place the thermostat in the thermostat housing with the thermostatic element end toward the housing bottom.
4. Align the sleeve with the groove in the thermostat housing bore and install the sleeve into the housing.
5. Position a new thermostat housing gasket on the intake manifold.
6. Install the thermostat housing and torque the screws.

Description	Nm	lb-in.	lb-ft
Thermostat housing screws	41		30

7. Reconnect the hoses to the thermostat housing. Tighten the hose clamps securely.

⚠ CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

8. Supply cooling water to the engine.
9. Start the engine and inspect for leaks.

NOTES:

COOLING SYSTEM

Section 6C - Closed Cooled Models

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6 C

Torque Specifications

Description	Nm	lb-in.	lb-ft
Heat exchanger end cap	12	108	
Thermostat cover screw	30		22
Thermostat housing to intake screw	33		24
Air manifold to heat exchanger screw	3	27	
Hose clamps around heat exchanger and bracket	3	26	
Hose clamps	Securely		
Drain plugs			

Lubricants / Sealants / Adhesives

Description	Where Used	Part Number
Perfect Seal	Heat exchanger end cap gaskets	92-34227-1

Specifications

Closed Cooling System Capacity

NOTE: *All capacities are approximate fluid measures.*

Closed Cooled Models	Liters (U.S. Qts)
Coolant volume in engine, heat exchanger, and exhaust	19.47 (20.5)
Seawater volume in conduits and tube side of heat exchanger	4.3 (4.5)

Coolant Specification

Description	Part Number
Extended Life Coolant 5/100 (Orange Color)	92-877770K1

Thermostat

Engine	Specifications
Closed cooled model	77 Degrees C (170 Degrees F)

Pressure Cap Rating

Engine	Specifications
All engines	110 kPa (16 psi)

Description

The cooling system is composed of two separate subsystems: the seawater system and the closed cooling system. The seawater system is similar in function to the fan used in an automobile because it absorbs heat from the closed cooling system as it passes through the heat exchanger. The closed cooling system is similar in function to the rest of the cooling system in an automobile.

The coolant recovery system keeps the reservoir full. Normal coolant overflow into the recovery bottle is approximately 230 ml. (1/2 pint) during warm-up. The coolant recovery system draws coolant back into the reservoir from the recovery bottle as the engine cools. As long as there is coolant in the recovery bottle, the reservoir should remain completely full. If not, there is a vacuum leak, usually at the hose leaving the reservoir or the gasket under the recovery filler cap.

IMPORTANT: The coolant (antifreeze) flows around the outside of the cooling tubes while seawater flows through the inside of the cooling tubes in the heat exchanger.

Coolant Recommendations

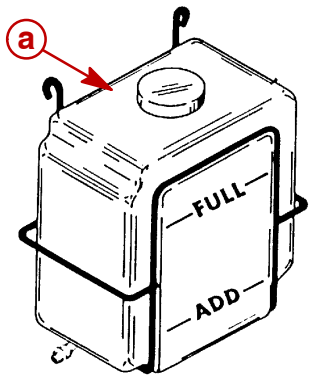
⚠ CAUTION

Alcohol or Methanol base antifreeze or plain water are not recommended for use in the fresh water section of cooling system at any time.

NOTE: *All factory installed closed cooling systems come filled with Extended Life Coolant. This antifreeze requires draining and replacing every five years or 1000 hours of operation, whichever comes first. For best results any top-off fluid used should be Extended Life Coolant. If Extended Life Coolant is unavailable, any type of ethylene glycol based antifreeze may be used, but it will require the draining and replacing of the coolant every two years or 400 hours of operation, whichever comes first.*

In areas where the possibility of freezing DOES NOT exist, it is permissible to use a solution of rust inhibitor and water (mixed to manufacturer's recommendations).

Maintaining Coolant Level



72520

Coolant Recovery Bottle

a - Fill cap

Before starting the engine each day, ensure that the coolant is visible in the coolant recovery bottle.

If the coolant is not visible, check the closed cooling system (including the coolant recovery system) for leaks and repair. Refill with the recommended coolant solution as outlined under Changing Coolant.

If the coolant is visible, start the engine and operate until it reaches normal operating temperature, then recheck the coolant level in the coolant recovery bottle. The coolant level MUST be between the ADD and FULL marks on the front of the bottle.

⚠ WARNING

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause the hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and remove the cap.

If the level is low, remove the fill cap from the coolant recovery bottle and add the required amount of coolant solution. Refer to Coolant Recommendations in this section.

Occasionally, ensure that the coolant recovery system is functioning properly by removing the pressure cap from the heat exchanger and checking the level. The coolant level should be up to the bottom of the heat exchanger filler neck. If low, examine the entire closed cooling section (especially the coolant recovery system) for leaks and repair.

IMPORTANT: When reinstalling the pressure cap, tighten it until it contacts the stops on the filler neck.

Pressure Cap Maintenance

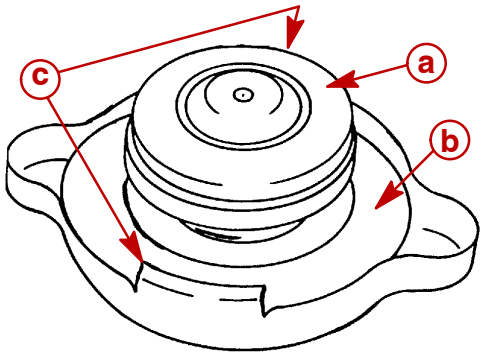
The pressure cap should maintain pressure the closed cooling system at normal engine operating temperature. This raises the boiling point of the coolant, thereby increasing the efficiency of the cooling system. To help ensure proper operation, the cap should be cleaned, inspected and pressure tested periodically.

⚠ WARNING

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and turn the cap all the way off.

1. Remove the pressure cap from the heat exchanger.
2. Wash the cap with clean water to remove any deposits or debris from the sealing surfaces.
3. Inspect the rubber seal on the cap for cuts, cracks or other signs of deterioration. If the seal is damaged, the cap MUST be replaced.
4. Inspect the gasket for deterioration and replace if necessary.
5. Check the condition of the locking tabs on the cap. Replace the cap if the tabs are bent or cracked.
6. Check the gasket for cracks or other damage.

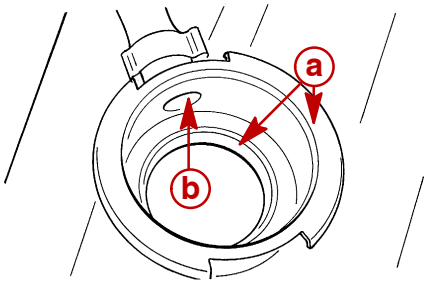
IMPORTANT: The cap MUST be replaced if damaged.



72714

a - Rubber seal
b - Gasket
c - Locking tabs (1 not shown)

7. Test the pressure cap.
8. Clean the sealing surfaces on the heat exchanger filler neck with a cloth. Inspect the surfaces for any damage or deposits that may prevent the cap from sealing properly.
9. Clean the coolant recovery passage in the heat exchanger filler neck with a wire and blow out with compressed air.



72715

a - Sealing surfaces
b - Coolant recovery passages

10. Reinstall the pressure cap. Tighten the cap until it contacts the filler neck.

Testing Closed Cooling System

Testing Coolant for Alkalinity

⚠ WARNING

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and turn the cap all the way off.

The coolant should be changed per the Maintenance Schedule recommendations and should be checked for alkalinity at least once between change intervals. To check the coolant for alkalinity, proceed as follows:

1. Obtain pink litmus paper from a local source.
2. Allow the engine to cool and remove the pressure cap from the heat exchanger and insert one end of the litmus paper into the coolant.
3. **If pink litmus paper turns blue,** the coolant is alkaline and need not be replaced.
4. **If pink litmus paper remains pink,** the coolant is not alkaline and MUST BE REPLACED, as explained under Changing Coolant.

Pressure Testing System

⚠ WARNING

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and turn the cap all the way off.

If the coolant section of the closed cooling system is suspected of leaking or not holding sufficient pressure, and no visible signs of leakage can be found, perform the following test:

1. Remove the pressure cap from the heat exchanger or the reservoir.
2. Clean, inspect and pressure test the pressure cap.
3. Clean the inside of the filler neck to remove any deposits or debris. Examine the lower inside sealing surface for damage. The surface must be perfectly smooth to achieve a good seal between it and the rubber seal on the cap. Ensure that the locking cams on the sides of the filler neck are not bent or damaged.
4. Adjust the coolant level to 25 mm (1 in.) below the filler neck.
5. Attach an automotive-type cooling system pressure tester to the filler neck and pressurize closed cooling section to amount specified in following chart.

Pressure Cap Rating	Amount of Pressure Applied to Closed Cooling System
110 kPa (16 psi)	138 kPa (20 psi)

6. Observe the gauge reading for approximately two minutes; the pressure should not drop during this time. If the pressure drops, proceed with the following steps until leakage is found.
7. While maintaining the specified pressure on the closed cooling section, visually inspect the external portion of the cooling system (hoses, gaskets, drain plugs, petcocks, core plugs, circulating pump seal, etc.) for leakage. Also listen closely for bubbling or hissing.
8. Test the heat exchanger.

9. If no leakage could be found in the above steps, the engine is leaking internally. Leaking may be caused by one or more of the following: loose cylinder head bolts or damaged gasket, loose intake manifold bolts or damaged gasket, loose exhaust elbow or distribution block retaining nuts or damaged gasket, cracked or porous cylinder head or block or cracked or porous exhaust manifold. Proceed as follows until the location of the internal leak is found.

   a. Start the engine. Re-pressurize the system to the previously specified amount and observe the pressure gauge on the tester. If the needle in the gauge vibrates, the compression or the combustion is leaking into the closed cooling section from a leak in the combustion chamber. Exact cylinders where the leakage is taking place can sometimes be found by removing the spark plug wires (one at a time) while observing the pressure gauge. Vibration will decrease or stop when the plug wire is removed from the leaking cylinder. Stop the engine.

   b. Remove the spark plugs (one at a time) from the cylinders and examine for the presence of coolant. A spark plug that is perfectly clean or milky appearing is a sure indication of a leak.

   c. Drain the oil from the engine and examine for coolant. Oil will usually be milky if coolant is present. If coolant is present, remove the engine from the boat and drop the oil pan. With the engine in the upright position, re-pressurize the closed cooling section to the previously specified amount and examine the internal surfaces of the engine to locate the leak.

   d. If no leakage can be found in the above steps, the entire engine must be disassembled and inspected for leaks.

Testing for Cylinder Head Gasket Leak

A leaking head gasket will cause combustion gas to be forced into the cooling system. The mixture of coolant and tiny air bubbles is a poor heat conductor and will overheat an engine quickly. Compression tests or cooling system pressure check normally will not detect the leak because the test pressure is far below the combustion pressures that cause the leak. An effective test is as follows:

IMPORTANT: Operate the boat in the water for this test. It is best to operate the engine at or above cruising speed during this test. Usually a failed head gasket will not cause the engine to overheat below cruising speed.

1. Install a clear plastic hose between the reservoir and the coolant recovery bottle. Use a 610-910 mm (2-3 ft) long hose for this test.
2. Route this hose so a U is formed.
3. Put enough coolant into the hose to fill the center 100-130 mm (4-5 in.) of the U-shape.
4. Observe the U-shape while the engine is operating.
   a. **During Idle and Warm-Up:** Some coolant and/or air will leave the reservoir.
   b. **During Cruising Speed (2500-3500 rpm):** Coolant and/or air leaving the reservoir should stop after approximately five minutes operating at a given rpm. A leaking head gasket will produce air bubbling through the U-shape, going to the coolant recovery bottle. The frequency and size of the bubbles will depend on the size of the leak.
   c. **At Higher Speeds (4000+ rpm):** Normal operation is the same as described above. A failed head gasket will cause the bubbles to come faster and may be accompanied by violent, intermittent bursts of coolant.

Do not confuse normal warm-up expansion with a failed head gasket. Normal warm-up produces an intermittent flow of coolant that will stop within approximately five minutes at a given rpm. A head gasket leak will not stop because the one thing that marks a failed head gasket is the continued passage of air. This may be accompanied by violent, intermittent bursts of coolant leaving the reservoir. If coolant flows evenly from the reservoir at cruising speed, something other than the head gasket is causing the engine to overheat.

Testing Pressure Cap

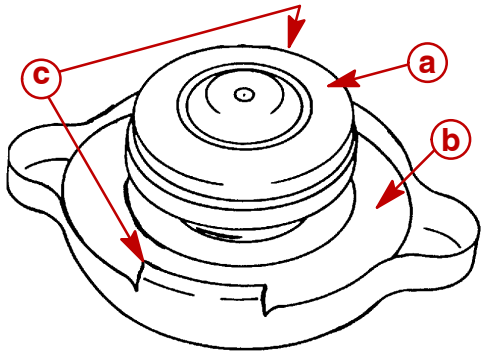
The pressure cap is designed to maintain a pressure of approximately its rated capacity once the engine has attained operating temperature. The cap should be cleaned, inspected and pressure-tested at regular intervals or whenever the cap is suspected of maintaining improper pressure.

⚠ WARNING

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and turn the cap all the way off.

1. Carefully remove the pressure cap from the reservoir or the heat exchanger.
2. Wash the cap with clean water to remove any deposits or debris from the sealing surfaces.
3. Inspect the gasket (if used) and the rubber seal on the cap for tears, cuts, cracks or other signs of deterioration. Replace the gasket, if damaged.
4. Replace the cap if the rubber seal is damaged.
5. Check the condition of the locking tabs on the cap. Replace the cap if the tabs are bent or cracked.

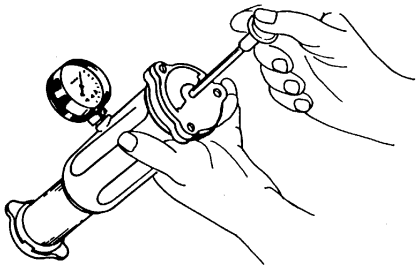
IMPORTANT: The cap MUST be replaced if damaged.



72714

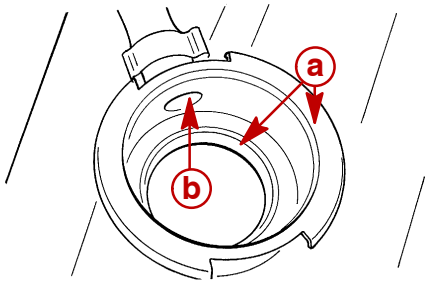
a - Rubber seal
b - Gasket
c - Locking tabs (1 not shown)

6. Using a cooling system pressure tester (similar to one shown), test the cap to ensure that it releases at the proper pressure and does not leak. (Refer to the instructions which accompany the tester for the correct test procedure.) The cap must relieve pressure at 110 kPa (16 psi), and must hold the rated pressure for 30 seconds without going below 75.8 kPa (11 psi). Replace the cap if it fails to fall within these limits.



72716

IMPORTANT: Before reinstalling the cap in the next step, examine the lower inside sealing surface in the filler neck to ensure that it is perfectly smooth and free of debris. Also, inspect the cam lock flanges on the sides of the filler neck to ensure that they are not bent.



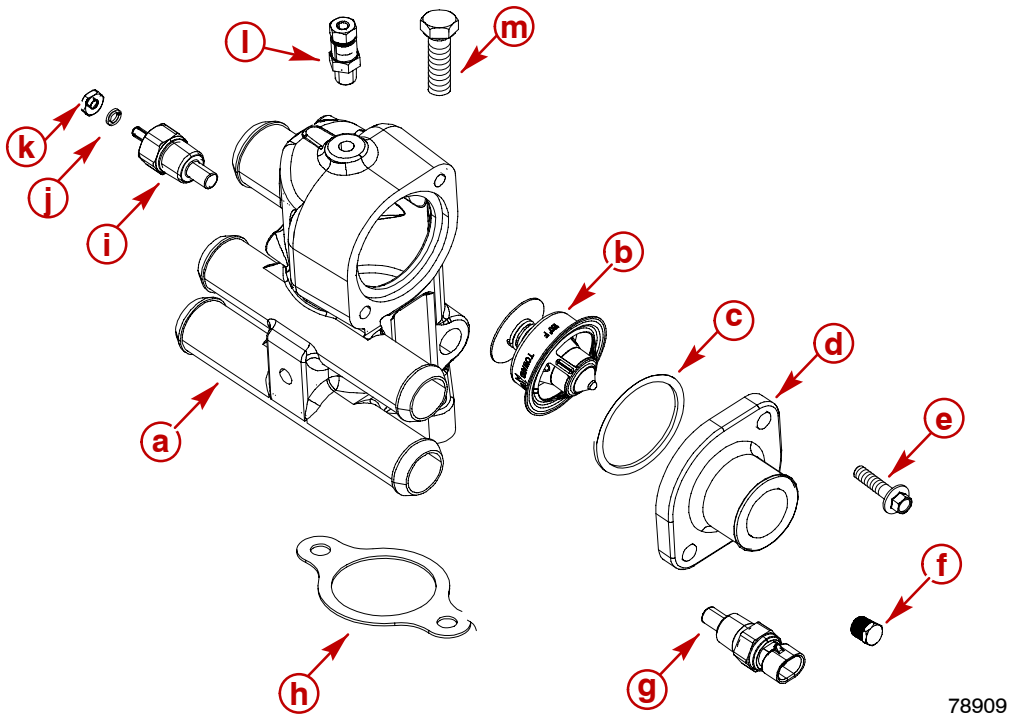
72715

a - Sealing surfaces
b - Coolant recovery passages

7. Reinstall the cap on the reservoir or the heat exchanger.

Thermostat

Exploded View



a - Thermostat housing
b - Thermostat
c - Thermostat seal
d - Thermostat housing cover
e - Thermostat housing cover screw (2)
f - Plug
g - Temperature sensor
h - Gasket
i - Temperature sender
j - Lockwasher
k - Nut
l - Air vent
m - Screw (2)

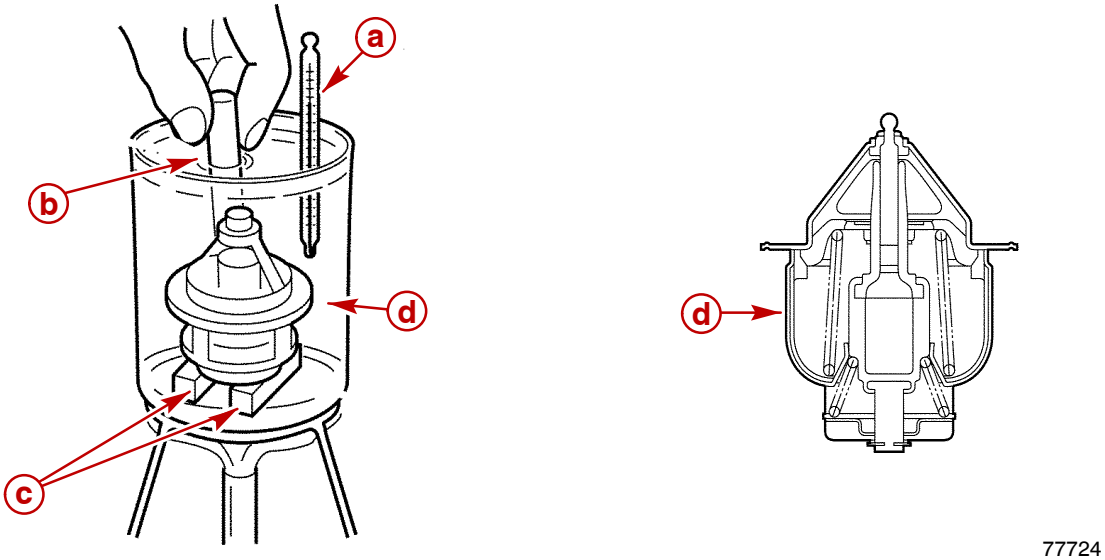
Removal

NOTE: *If the coolant flow is restricted or fails to occur, a wire should be repeatedly inserted into all drain holes to ensure that there are no obstructions in the passages. Remove the fitting, if necessary, to insert the wire completely into the drain hole.*

1. Drain the coolant from the engine.
2. Disconnect the hoses from the thermostat cover.
3. Remove the thermostat cover bolts, the cover, and the gasket.
4. Remove the thermostat from the thermostat housing.

Testing

1. Place the thermostat on blocks in a container.
2. Completely submerge the thermostat in water.
3. Heat the water.
4. Stir the water constantly to avoid direct heat being applied to the thermostat.
5. Refer to Specifications:
   a. Check the thermostat initial opening temperature.
   b. Check the thermostat full opening temperature.
   c. Check valve lift at fully open position.



Typical thermostat

a - Thermometer
b - Agitating rod
c - Wooden blocks
d - Thermostat

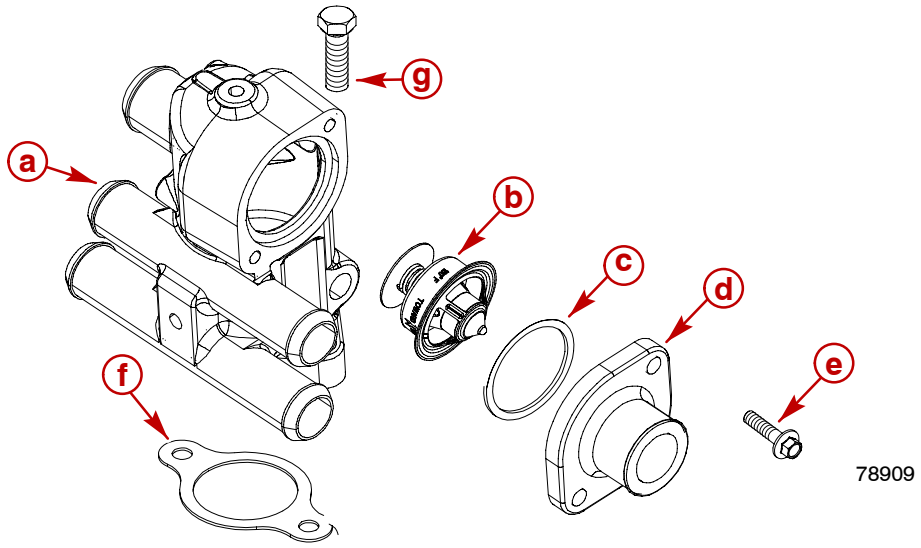
6. Replace if specifications are not met or damage is discovered during inspection.

Installation

1. Remove the thermostat housing and the gaskets. Discard the gaskets.
2. Clean the gasket surfaces on the thermostat cover, the thermostat housing, and the intake manifold.
3. Position the gasket on the intake manifold. Place the thermostat housing on the gasket.
4. Torque the screws.

Description	Nm	lb-in.	lb-ft
Thermostat housing to intake screw	33		24

5. Install the rubber seal on the thermostat flange.
6. Install the thermostat into the thermostat housing.
7. Install the thermostat cover. Torque the screws.



a - Thermostat housing
b - Thermostat
c - Thermostat housing seal
d - Thermostat housing cover
e - Thermostat housing cover screw (2)
f - Gasket
g - Thermostat housing to intake screw (2)

Description	Nm	lb-in.	lb-ft
Thermostat cover screw	30		22

8. Connect the hoses. Tighten the hose clamps securely.
9. Supply cooling water, start the engine, and inspect for leaks.

Changing Coolant

Closed Cooling Section

The engine and exhaust sections of closed cooling system should remain filled year-round with the recommended coolant solution. Do not drain closed cooling section for storage, as this will promote rusting of internal surfaces. If engine will be exposed to freezing temperatures, make sure that closed cooling section is filled with Extended Life Coolant or an ethylene glycol antifreeze and water solution, mixed to manufacturer's recommended proportions, to protect engine to lowest temperature to which it will be exposed. If necessary, change coolant using coolant specified in "Coolant Recommendations."

Change Intervals

If the closed cooling system is factory installed, drain and flush coolant from the closed cooling system at least every five years or 1000 hours of operation, whichever comes first. It should also be changed whenever exhaust gases have entered the system.

If the system is not factory installed or has had anti-freeze other than Extended Life Coolant added, it must be changed every two years or 400 hours of operation, whichever comes first.

Draining

⚠ WARNING

Allow engine to cool before removing pressure cap. Sudden loss of pressure could cause hot coolant to boil and discharge violently. After engine has cooled, turn cap 1/4 turn to allow any pressure to escape slowly, then push down and turn cap all the way off.

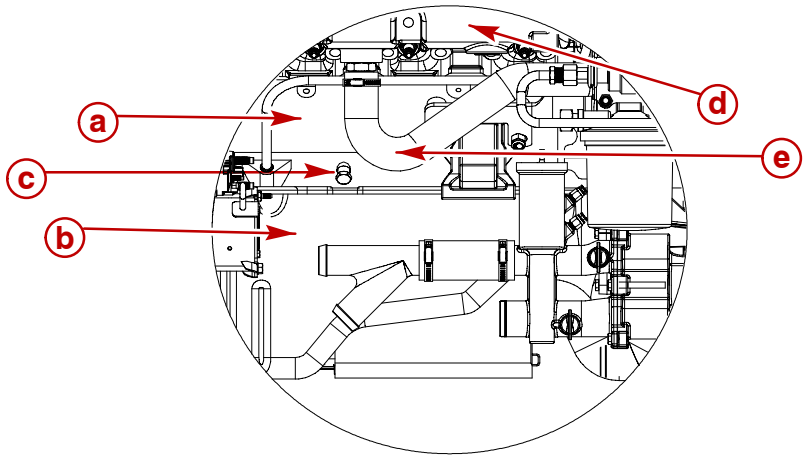
IMPORTANT: A wire should be inserted into drain holes to ensure that foreign material is not obstructing the drain holes. On some models with two piece petcock, removal of petcock may be required so that wire can be inserted completely into drain hole.

IMPORTANT: Engine must be as level as possible to ensure complete draining of cooling system.

IMPORTANT: Closed cooling section must be kept filled year round with recommended coolant. If engine will be exposed to freezing temperatures, make sure closed cooling section is filled with Extended Life Coolant or an ethylene glycol antifreeze and water solution properly mixed to protect engine to lowest temperature to which it will be exposed.

The following draining instructions apply to all engines equipped with closed cooling. The location of petcocks that require opening and hoses that require removal are represented on the following pages for the individual engines.

1. Remove pressure cap from coolant tank.
2. On port and starboard side of engine block, remove the block pipe plugs. Drain coolant into proper container.
3. On port and starboard side of engine block, remove the coolant hose from the bottom side of the exhaust manifold. Drain coolant into proper container.

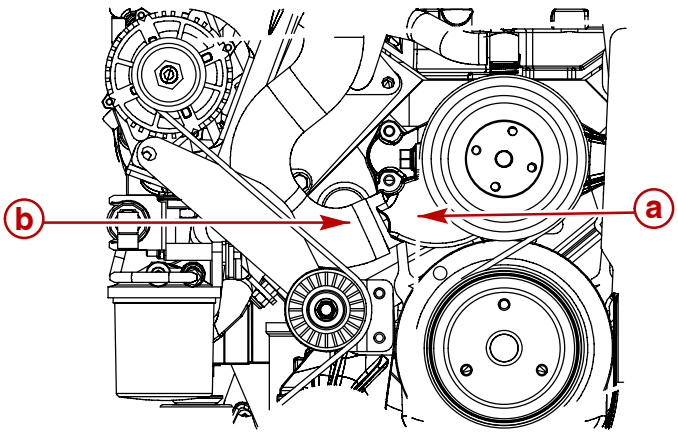


78905

Port and starboard side similar

a - Engine block
b - Oil pan
c - Engine block drain plug
d - Exhaust manifold
e - Exhaust manifold coolant hose

4. Remove the heat exchanger to water circulating pump hose at the pump connection. Drain coolant into proper container.



78648

a - Water circulating pump
b - Hose from heat exchanger to water circulating pump

5. After coolant has drained completely, reinstall block pipe plug and hoses. Tighten clamps securely.
6. Remove coolant recovery bottle from mounting bracket and discard the coolant into a proper container.

Cleaning System

Closed Cooling Section

Closed cooling section of closed cooling system should be cleaned at least once every five years or whenever decreased cooling efficiency is experienced.

A good grade automotive cooling system cleaning solution may be used to remove rust, scale or other foreign material. Always follow manufacturer's instructions for the cleaner.

If closed cooling section is extremely dirty, a pressure flushing device may be used to flush out remaining deposits. Flushing should be done in direction opposite normal coolant flow to allow water to get behind deposits and force them out. Refer to instructions that accompany flushing device for proper hookup and flushing procedure.

NOTICE
For information and procedures on draining and flushing Seawater Section of Closed Cooling (Coolant) Models, and for cold weather or extended storage, refer to the appropriate Mercury MerCruiser Service Manual.

Seawater Section

Cooling efficiency of an engine with closed cooling is greatly dependent upon heat transfer through the tubes within the heat exchanger. During engine operation, contaminants within the seawater (such as salt, silt, lime, etc.) collect on the inside of the tubes, thus reducing heat transfer and greatly decreasing heat exchanger efficiency. It is, therefore, recommended that the seawater section of the heat exchanger be cleaned as specified in the appropriate Mercury MerCruiser Service manual or whenever decreased cooling efficiency is suspected.

Heat Exchanger

Testing

INTERNAL LEAKS

An internal leak will allow coolant to enter into the seawater circuit when the closed cooling circuit is pressurized.

1. Remove a seawater hose from the exchanger. Do not drain the exchanger.
2. Pressurize the closed cooling circuit to 110-138 kPa (16-20 psi) with a radiator tester.
3. If seawater begins to flow from the seawater hose fitting of the heat exchanger, there is a leak.

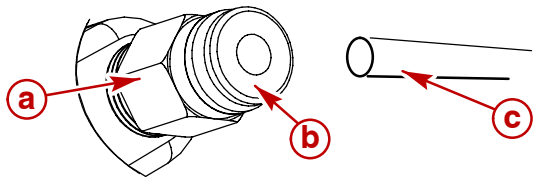
BLOCKAGE

IMPORTANT: Seawater flows THROUGH the tubes in the exchanger. Closed cooling coolant flows AROUND the tubes.

1. Remove the end caps and inspect for any blockage in the seawater circuit (broken impeller blades, weeds, etc.).
2. Remove the closed cooling circuit hoses and inspect the tubes just inside the nipples. Because the complete exchanger cannot be inspected, the heat exchanger should be replaced if blockage is suspected.

Removal

1. Allow engine to cool.
2. Drain the seawater from the engine.
3. Drain the coolant from the engine.
4. Remove each air line from the air manifold by pressing on the fitting and pulling the line out.



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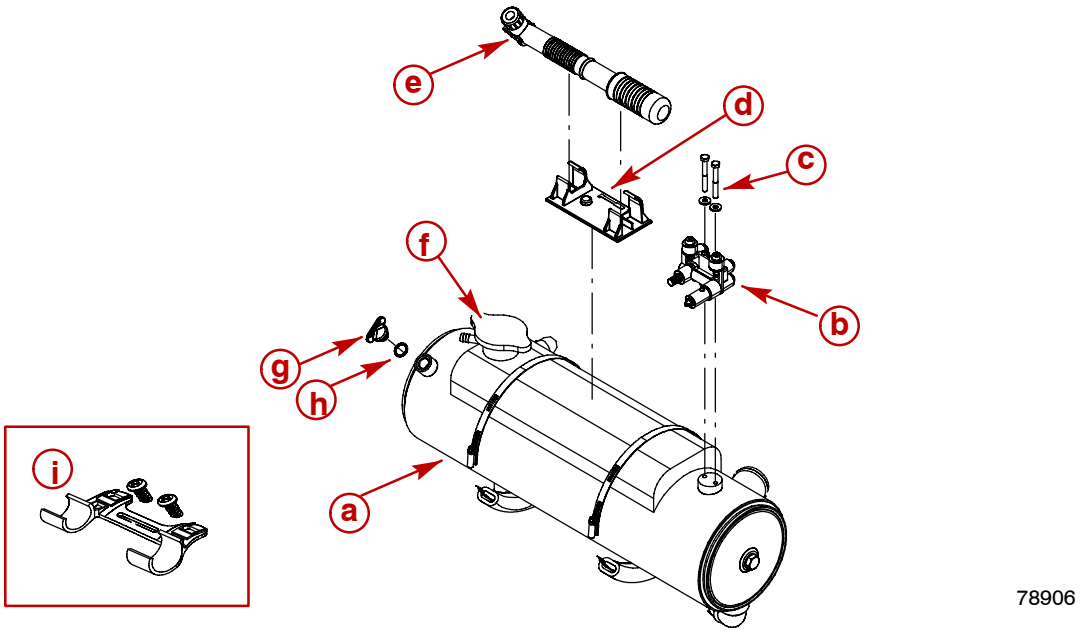
a - Air line fitting
b - Release location
c - Air line

5. Remove the hoses from the heat exchanger.

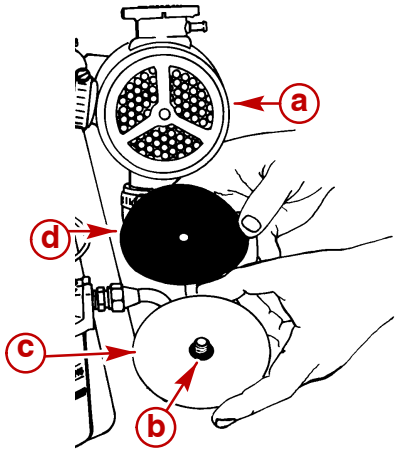


a - Heat exchanger
b - Air manifold
c - Air manifold screws and washers
d - Air pump bracket (later style)
e - Air pump
f - Heat exchanger cap
g - Air vent plug
h - O-ring
i - Air pump bracket (early style)

6. Remove the 2 large hose clamps fastening the heat exchanger to the engine.
7. Remove the heat exchanger.

Disassembly

1. Remove the air pump from the air pump bracket.
2. If air pump bracket is secured with adhesive, do not remove.
3. If air pump bracket is secured by screws, remove the air pump bracket.
4. Remove the air manifold.
5. Remove the screws attaching the end cap to the heat exchanger.
6. Remove the end caps and gaskets.



71515

a - Heat exchanger
b - Sealing washer
c - End cap
d - Gasket

Cleaning And Inspection

1. Clean old gasket material and sealant from surfaces. Do not nick or gouge the surfaces.
2. Use a long rod and wire brush to clean out heat exchanger tubes.
3. Inspect each part for cracks or other damage. Replace as necessary.
4. Clean and paint exterior surfaces as required to prevent corrosion.

Repair

IMPORTANT: Braze with BCUP 2 rod or silver solder. Care must be taken not to melt the other joints during repair.

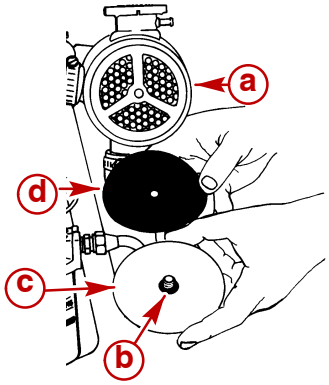
1. Internal leaks can be repaired by brazing shut the ends of the leaking tube. This is only a temporary fix because usually another tube will start leaking after a short period of time and this also causes a reduction in the cooling capacity. Do not close more than three tubes.
2. Fittings and drains that have been broken off the heat exchanger can be reattached by brazing.

Assembly

1. Apply sealant to both sides of new end cap gaskets.

Description	Where Used	Part Number
Perfect Seal	Heat exchanger end cap gaskets	92-34227-1

2. Install new gaskets, new sealing washers, and end caps onto heat exchanger. Torque the end cap screws.



71515

a - Heat exchanger
b - Sealing washer
c - End cap
d - Gasket

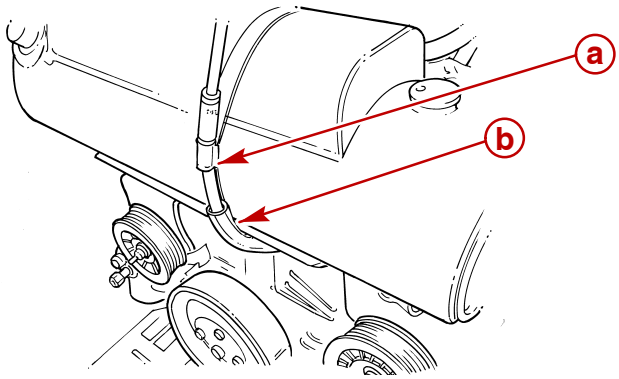
Description	Nm	lb-in.	lb-ft
Heat exchanger end cap	6	54	

3. If applicable, fasten the air manifold to the heat exchanger.
4. Torque screws.

Description	Nm	lb-in.	lb-ft
Air manifold to heat exchanger screw	3	27	

Installation

1. Lower heat exchanger onto bracket and simultaneously attach water hoses.
2. Ensure that all hose ends are aligned and fully seated on heat exchanger fittings. Tighten all hose clamps securely.
3. Install large hose clamps around heat exchanger bracket and heat exchanger.
4. Install the hose clamps around the heat exchanger. The rubber hose should be underneath the bracket to prevent the bracket from directly contacting the hose clamp and potentially breaking it.



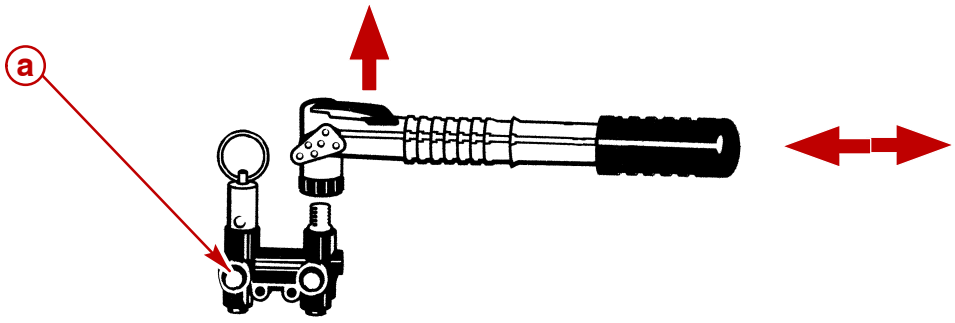
78405

a - Hose clamp
b - Rubber hose

5. Torque hose clamps.

Description	Nm	lb-in.	lb-ft
Hose clamps around heat exchanger and bracket	3	26	

6. Install the air lines to the air manifold by inserting the line into the fitting until a positive stop is encountered.
7. Ensure the air lines are installed properly.
   a. Install air pump on the fitting in the air manifold.

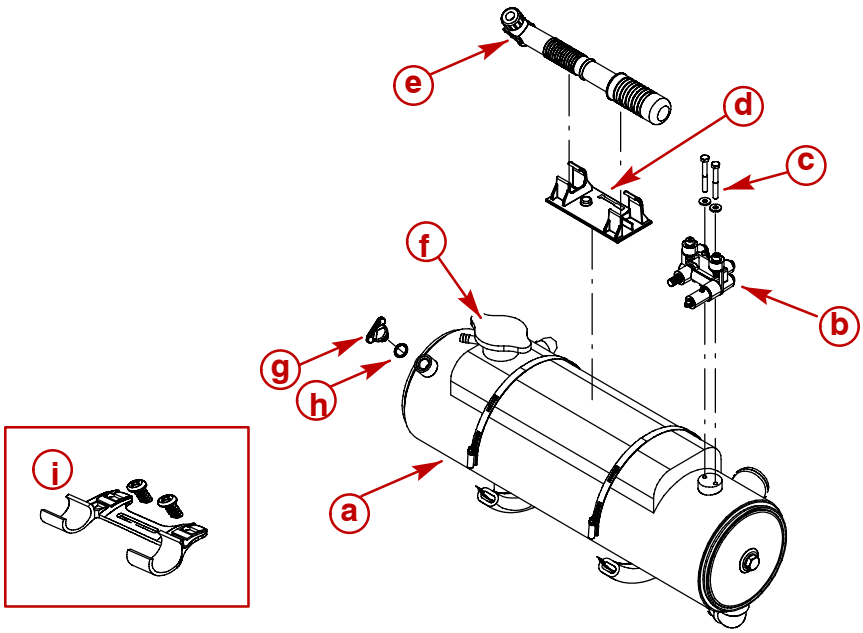


77638

a - Green indicators

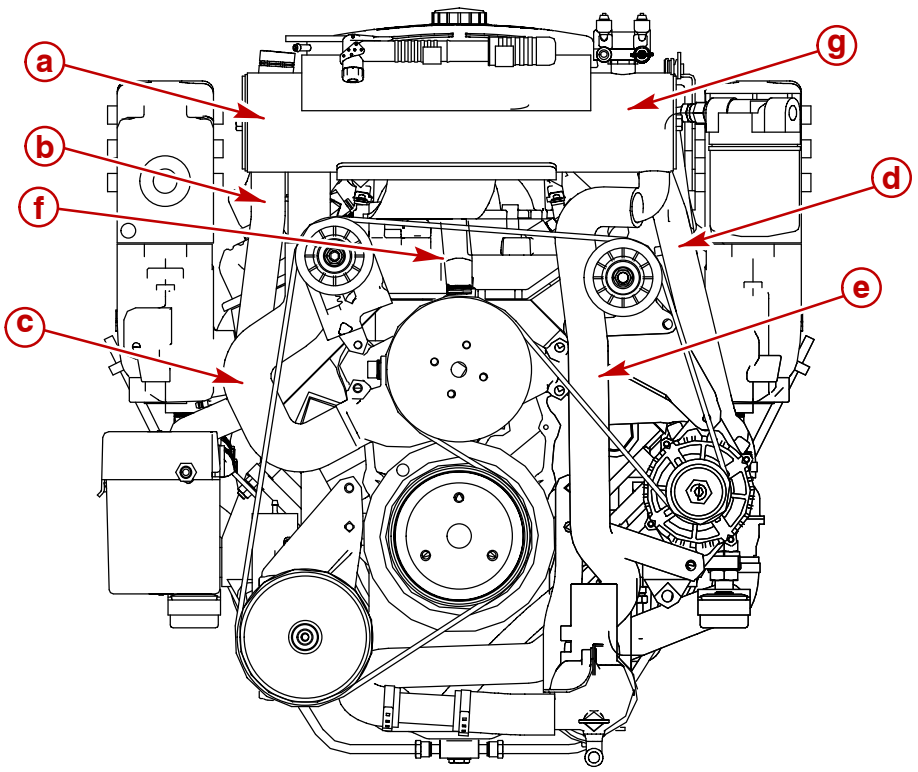
   b. Pull lever on air pump up (vertical) to lock pump on the fitting.
   c. Pump air into the system until both green indicators extend. If the green indicators do not extend, the air lines are not attached properly.
8. Fill closed cooled system.

Heat Exchanger Bracket Hardware



a - Heat exchanger
b - Air manifold
c - Air manifold screws and washers
d - Air pump bracket (later style)
e - Air pump
f - Heat exchanger cap
g - Air vent plug
h - O-ring
i - Air pump bracket (early style)

Heat Exchanger Hose Connections



77954

Typical Engine Shown

- **a** - Heat exchanger
- **b** - Starboard heat exchanger-to-exhaust manifold hose
- **c** - Water circulating pump hose
- **d** - Port heat exchanger-to-exhaust manifold hose (MCM)
- **e** - Cool fuel system-to-heat exchanger hose
- **f** - Heat exchanger bypass hose
- **g** - Coolant identification decal

EXHAUST SYSTEMS

Section 7A - Dry Joint Identification

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7 A

General Information

IMPORTANT: The Identification section outlines new components and information needed for Section 7-Exhaust Systems.

Closed Cooled Models

Engine models covered in this service manual supplement are considered a full closed cooling system. The term full closed cooling system, also known as full fresh water cooled or full FWC refers to the use of ethylene glycol mixture in the engine and the exhaust water jackets. Engine models in service manuals number 24, 25, 31,and 32 are one-half (1/2) closed cooling systems or 1/2 systems. The term 1/2 closed cooling system refers to the use of ethylene glycol mixture in the engine cooling passages and the use of seawater in the exhaust water jackets.

Seawater Cooled Models

The term seawater cooled, also known as raw water cooled or RWC, refers to the use of water for cooling throughout the system, such as seawater in the engine cooling passages and in the exhaust water jackets. This water source is picked up through the sterndrive and engine seawater pump.

Warm Manifolds

Warm manifolds contain fluid temperature that enters the exhaust manifold at greater than or equal to 54 degree Celsius (130 degree Fahrenheit). The temperature is warm enough to evaporate moisture that collects on interior exhaust passages due to condensation. The models covered in this Service Manual Supplement are warm manifold engines.

Dry Joint

Dry joint is the new exhaust system where the water porting in the exhaust components has been designed to prevent water from entering the engine. The models covered in this Service Manual Supplement are dry joint engines.

Serial Number Breaks

Warm Manifold and Cold Riser Models	Serial Number
Sterndrive (MCM) Models	0M600000 through 0M614999
Inboard and Tow Sports (MIE) Models	0M317000 through 0M389999

Warm Manifold And Warm Riser Models	Serial Number
Sterndrive (MCM) Models	0M615000 And Above
Inboard and Tow Sports (MIE) Models	0M390000 And Above

Turbulator Gasket

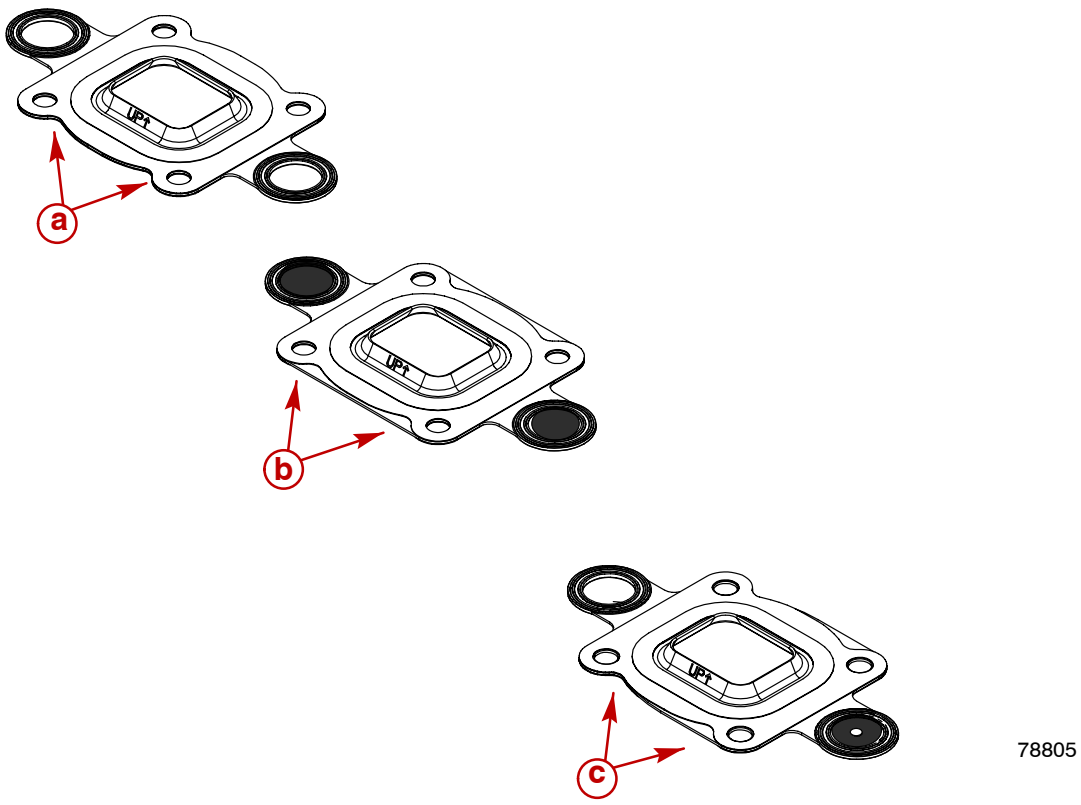
Identification

⚠ CAUTION

Avoid severe engine damage. The turbulator gasket used MUST BE the Mercury MerCruiser turbulator gasket specified for your engine package. Engine damage that results from improper gasket use is considered misuse of the engine and is not covered under Mercury MerCruiser Warranty.

IMPORTANT: Gasket identification can be viewed externally on the engine package. The outer edge of each turbulator gasket identifies the gasket and the gasket position.

- The full flow gasket is contoured at the edge to show full flow at each water port.
- The block off gasket is straight at the edge to show no flow at each port.
- The restrictor gasket is contoured at one edge of gasket to show full flow. The other edge of gasket is straight to show restricted flow.



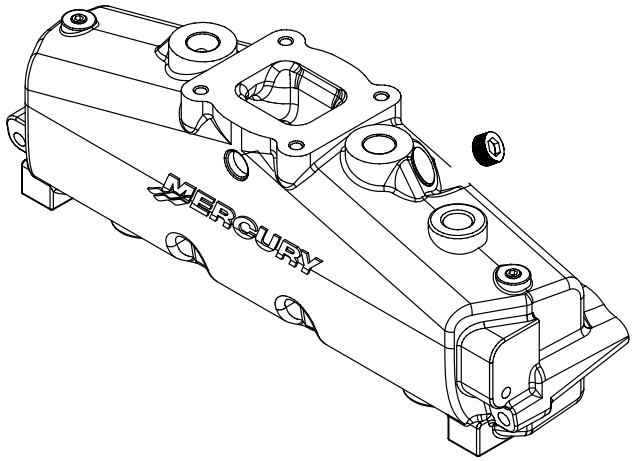
78805

a - Full flow gasket
b - Block off gasket
c - Restrictor gasket

NOTE: *Gasket is not reusable. Inspect for proper gasket replacement before disassembly and assembly.*

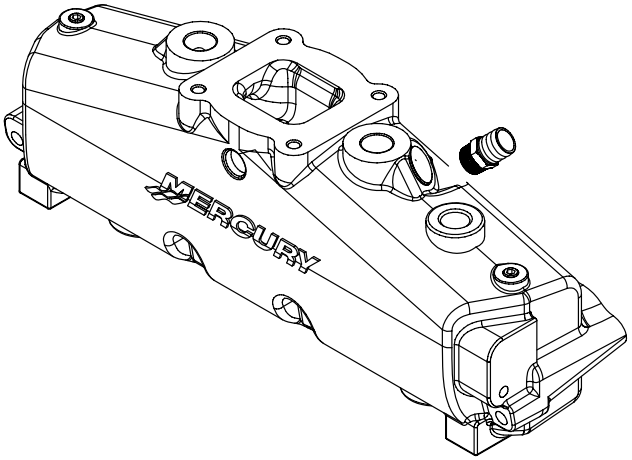
Exhaust Manifold

The warm exhaust manifold used in this service manual supplement is a new casting design and cannot be replaced with the previous Mercury MerCruiser exhaust manifold casting. This warm exhaust manifold casting is used in cold riser and warm riser applications.



78900

Exhaust manifold outlet water port with pipe plug



78900

Exhaust manifold outlet water port with hose fitting

NOTE: *Using Perfect Seal on water ports is a preventive measure for corrosion deterioration.*

Manifold Leak Test

NOTE: *One block-off plate must have an attachment for a compressed air hose.*

1. Using suitable block-off plates, plugs and new gaskets, seal the manifold openings.
2. Attach an air hose to the block-off plate.
3. Apply 138 kPa (20 psi) of air pressure and submerge the manifold in water.
4. Air bubbles will indicate a leak. Repair or replace, if necessary.

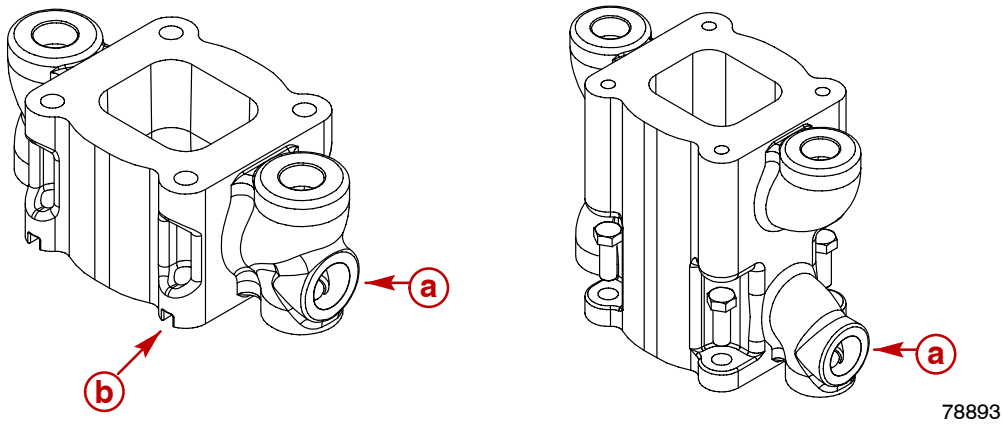
Exhaust Riser

Cold Riser Casting

NOTE: *The position of the riser water port and castings are different between the cold riser model and the warm riser model.*

The 76 mm (3 in.) and the 152 mm (6 in.) cold risers identified in this service manual supplement can only be replaced with Mercury MerCruiser warm riser castings as cold risers will not be ofered as a service part. Warm riser castings require the use of additional hose kits. Refer to the *Mercury Precision Parts/Quicksilver Accessories Guide.*

Cold riser castings can be easily identified by the water ports and drain holes on the casting.



76 mm (3 in.) riser **152 mm (6 in.) riser**

a - Cold riser water port is positioned to the bottom side of casting, closest to exhaust manifold
b - Drain holes on bottom of 76 mm (3 in.) casting

Warm riser castings can be used on cold riser models, but require the use of the hose kits. The engine will have to be changed to warm risers.

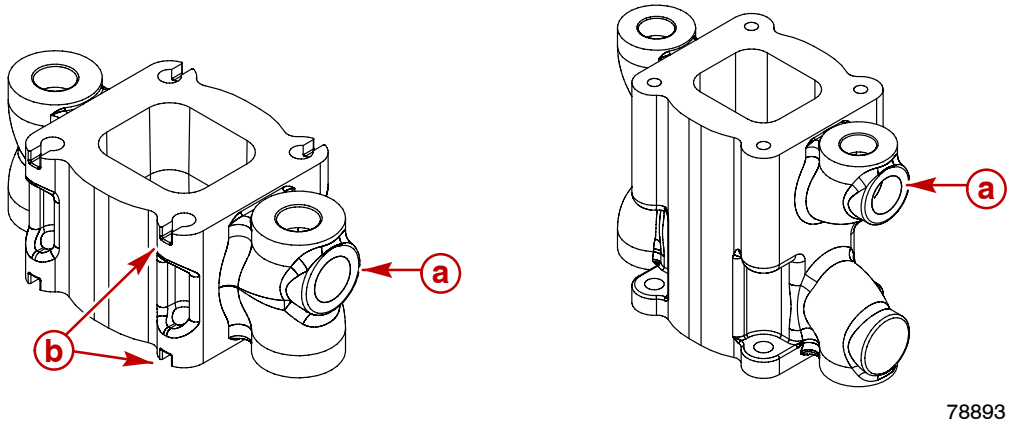
NOTE: *Using Perfect Seal on water ports is a preventive measure for corrosion deterioration.*

Warm Riser Casting

NOTE: *The position of the threaded water port is different between the cold riser model and the warm riser model.*

The 76 mm (3 in.) and 152 mm (6 in.) warm riser identified in this service manual supplement is a new casting design and cannot be replaced with the previous Mercury MerCruiser riser castings. Riser castings used for the cold riser model cannot be used for warm riser models.

Warm riser castings can be used on cold riser models, but require the use of additional hose kits. The engine will have to be changed to warm risers.



76 mm (3 in.) riser **152 mm (6 in.) riser**

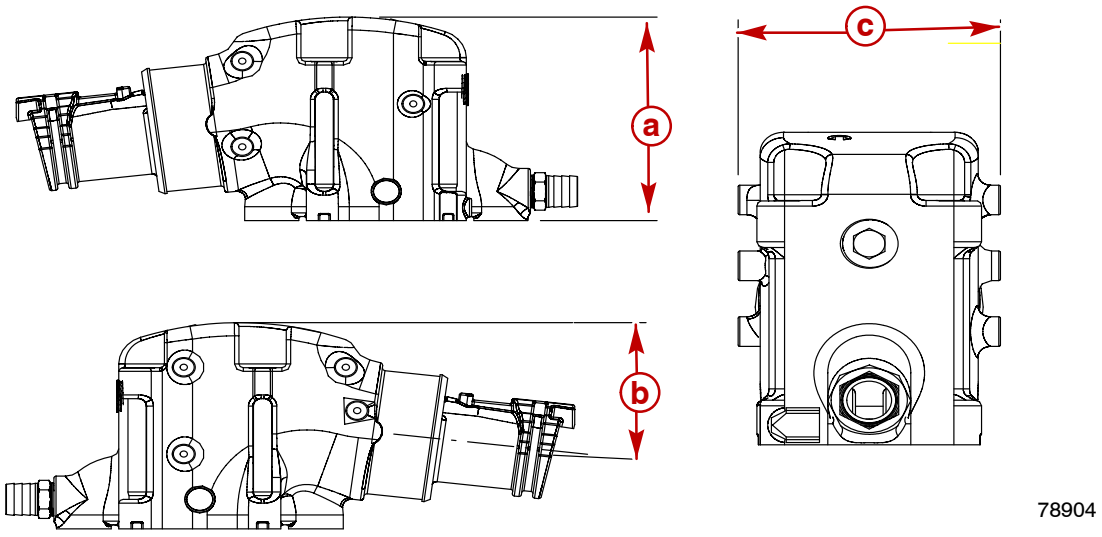
a - Warm riser water port is positioned to the top side of casting, closest to exhaust elbow
b - Drain holes on top and bottom of 76 mm (3 in.) casting

NOTE: *Using Perfect Seal on water ports is a preventive measure for corrosion deterioration.*

Exhaust Elbow

MCM Models And Ski V-Drive Models

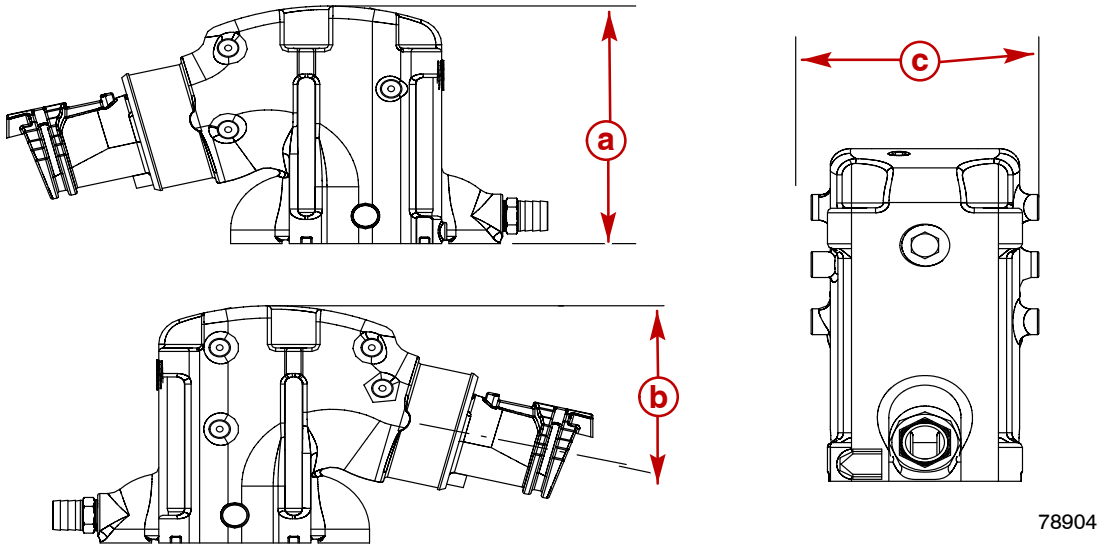
The 7 degree exhaust elbows identified are a new casting design and should not be replaced with previous Mercury MerCruiser elbow castings.



a - 169 mm (6.65 in.)
b - 7 degree
c - 120 mm (4.74 in.)

Inboard Models

The 14 degree exhaust elbows identified are a new casting design and should not be replaced with previous Mercury MerCruiser elbow castings.



a - 207 mm (8.15 in.)
b - 14 degree
c - 120 mm (4.74 in.)

Exhaust Elbow Fasteners

Assembly scenario	Engine Model	Fastener Description
Elbow to manifold or elbow to 152 mm (6 in.) riser	All MCM Models, and Ski V-drive (7 degree elbow)	3/8-16 X 5-3/4 in. (146.05 mm) long hex flange head with pre-applied locking compound
Elbow and 76 mm (3 in.) riser to manifold	MCM models with 76 mm (3 in.) riser	3/8-16 X 9 in. (228.6 mm) long hex head with pre-applied locking compound and flat washer
152 mm (6 in.) riser to manifold	Any model with 152 mm (6 in.) riser	3/8-16 X 1 in. (25.4 mm) long hex flange head with pre-applied locking compound
Elbow to manifold or elbow to 152 mm (6 in.) riser	All inboards with 14 degree elbow (taller elbow)	3/8-16 X 7-1/2 in. (190.5 mm) long hex head with pre-applied locking compound and flat washer
Elbow and 76 mm (3 in.) riser to manifold	All inboards with 14 degree elbow (taller elbow) and 76 mm (3 in.) riser	3/8-16 X 10-1/2 in. (266.7 mm) long hex head with pre-applied locking compound and flat washer

IMPORTANT: To ensure correct torque, the 7-1/2 in. (190.5 mm) long, 9 in. (228.6 mm) long and 10-1/2 in. (266.7 mm) long exhaust elbow screws require that a specific flat washer be used in conjunction with the screw. Refer to the *Mercury Precision Parts/Quicksilver Accessories Guide.*

EXHAUST SYSTEMS

Section 7B - Manifolds And Elbows

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7
B

General Information

This section contains new components and procedures. Before attempting repairs or tune-up, it is suggested that the procedure first be read through to gain knowledge of the methods and tools used and the cautions and warnings required for safety.

Torque Specifications

NOTE: *Securely tighten all fasteners not listed below.*

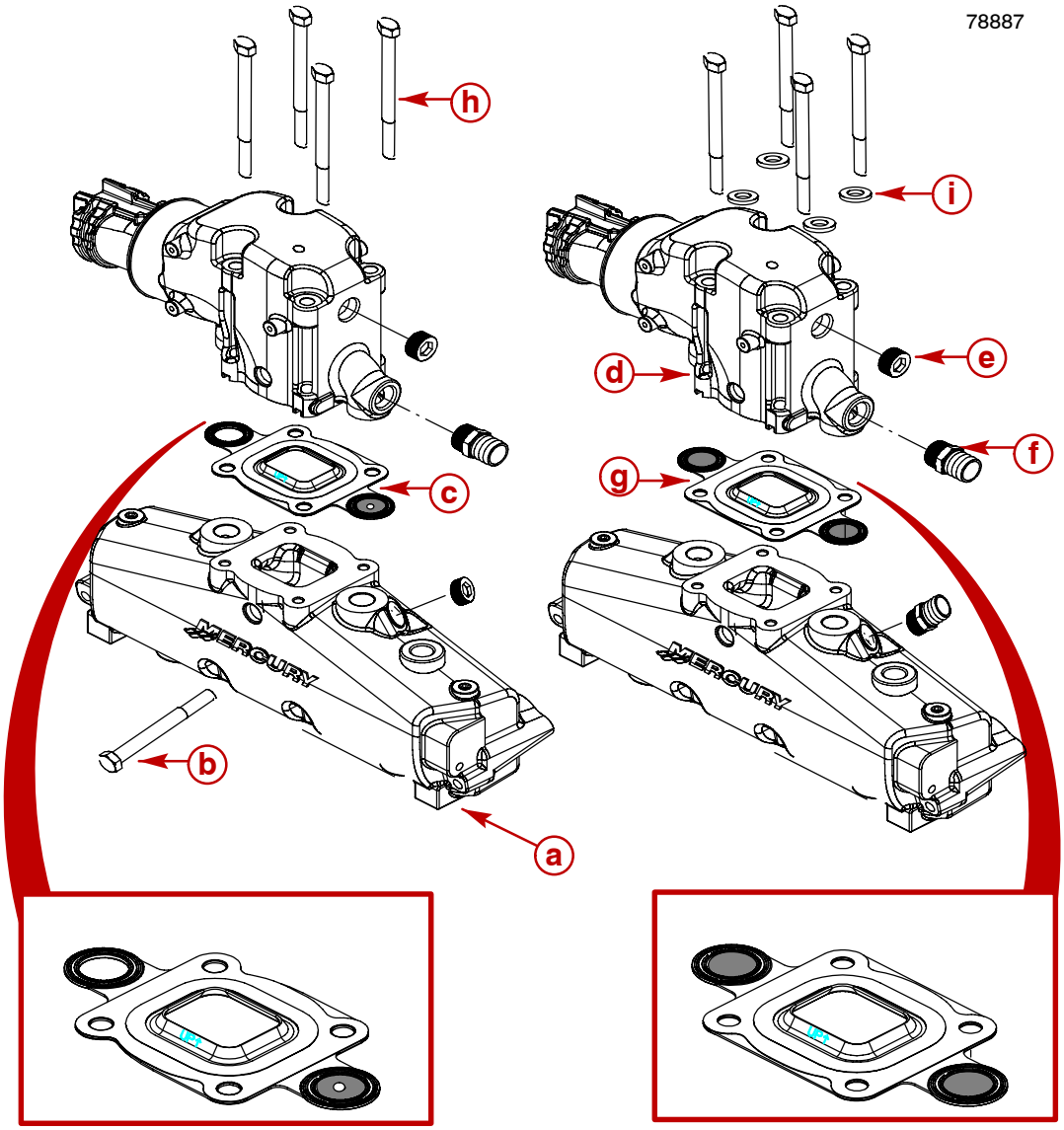
Description		Nm	lb-in.	lb-ft
Exhaust elbow to exhaust manifold screw				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45
Exhaust manifold to cylinder head bolt		34		25
Exhaust manifold and exhaust elbow pipe plug		50		37
Exhaust manifold and exhaust elbow hose fitting		50		37

Lubricants / Sealants / Adhesives

Description	Where Used	Part Number
Quicksilver Perfect Seal	Water ports on the exhaust manifold and exhaust elbow	92-34227-1
	Screw threads	
Loctite 567 Pipe Sealant	Hose fitting and pipe plug	92-804874

Exploded View

Warm Manifolds



Seawater cooled assembly **Closed cooled assembly**

NOTE: *7 degree elbows shown, 14 degree similar*

- **a** - Exhaust manifold
- **b** - Manifold to cylinder head bolt
- **c** - Restrictor gasket with turbulator (seawater cooled models)
- **d** - Exhaust elbow
- **e** - Pipe plug
- **f** - Hose fitting
- **g** - Block off gasket with turbulator (closed cooled models)
- **h** - Exhaust elbow to exhaust manifold screw
- **i** - Flat washer used with 14 degree elbow (Refer to Section 7A - Dry Joint Identification)

Removal

⚠ WARNING

Avoid injury or death and power package damage from an electrical shock, fire or explosion. Always disconnect both battery cables from the battery before servicing the power package.

1. Disconnect both battery cables from the battery.

⚠ CAUTION

Avoid severe engine damage. Exhaust elbows and manifolds MUST BE drained to prevent coolant / water from entering combustion chambers when exhaust elbows are removed.

1. **Seawater cooled models:** Drain the seawater section of the engine.
1. **Closed cooled models:** Drain the coolant section of the engine. Refer to Section 6C.
2. Disconnect the engine exhaust hoses. Retain fasteners.
3. Disconnect all hoses from the exhaust manifold and exhaust elbow. Retain fasteners.
4. Remove and retain any items or components that are mounted to the manifold and the exhaust elbow of the engine.
5. Remove the exhaust elbow. Retain fasteners.
6. Remove the exhaust manifold. Retain fasteners.
7. Discard used gaskets.

Cleaning And Inspection

1. Clean the gasket material from all surfaces and wash the parts in solvent.
2. Inspect the water passages for foreign material. The passages must be clean for efficient cooling.

NOTE: *If more thorough inspection is desired, the pipe plugs may be removed from the exhaust manifold and the exhaust elbow.*

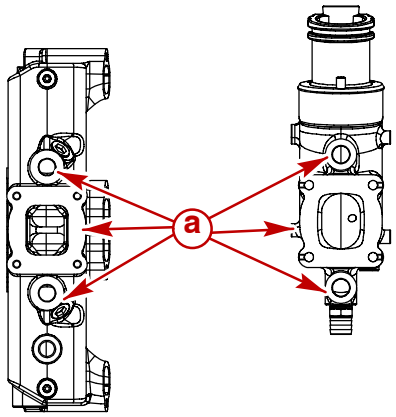
IMPORTANT: If the pipe plugs are removed, coat the threads with sealant before reinstalling.

Description	Where Used	Part Number
Loctite 567 Pipe Sealant	Pipe plug	92-804874

3. Inspect the manifold, elbow, and riser for cracks.
4. Inspect all parts carefully. Machined surfaces must be clean and free of all marks and deep scratches or water and exhaust leaks may result.
5. Inspect for damaged metal caused by saltwater or exhaust gas corrosion in the manifold, elbow, and riser.

IMPORTANT: If bare metal is present on the gasket sealing surface, Perfect Seal should be applied to that area before assembly.

6. Measure the surface flatness of all gasket surfaces on the manifold, elbow, and riser.



78748

a - Gasket sealing surface

NOTE: *Only use this specification if the gasket surfaces on used exhaust components have to be machined to remove minor corrosion.*

Description		mm (in.)
Surface Flatness	Maximum overall difference	0.07 (0.003)

NOTE: *The maximum material that can be removed is 0.25 mm (0.010 in.). When torquing the attaching bolts, ensure that they are not contacting the bottom of the threaded hole in the manifold.*

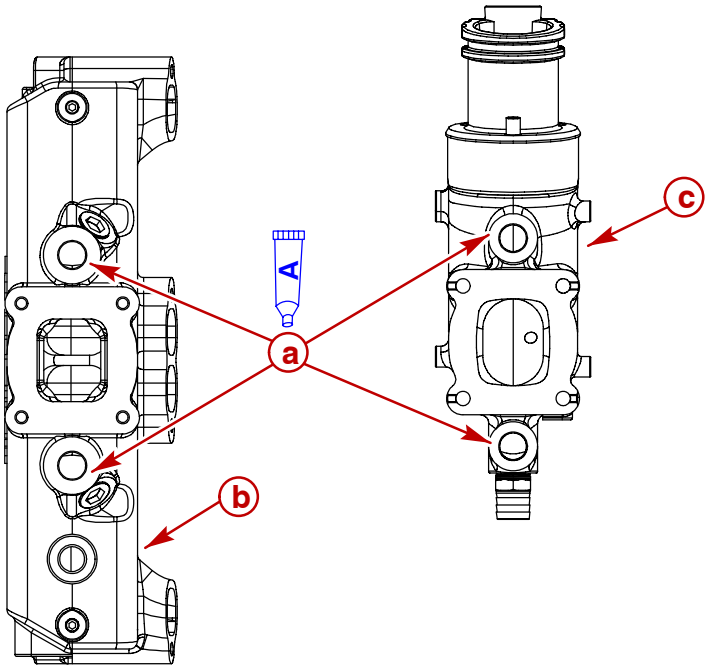
NOTE: *Gasket is not reusable. Inspect for proper gasket replacement before disassembly and assembly.*

7. Replace all damaged components.

Reassembly

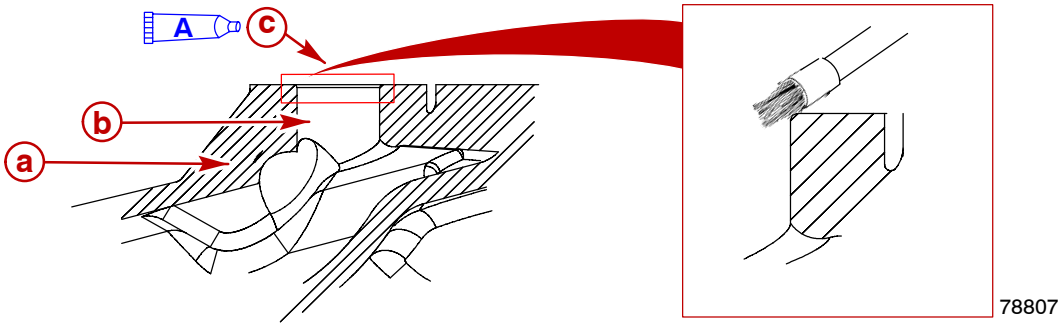
IMPORTANT: The edge of the water ports on all cast iron parts must be coated with Perfect Seal during assembly.

1. If exhaust elbow assembly is disassembled or risers are added, apply sealant to edge of all water ports (exhaust manifold, both sides of the riser, and exhaust elbow).



78748

a - Water ports
b - Exhaust manifold
c - Exhaust elbow



78807

a - Exhaust manifold (cross section)
b - Exhaust manifold water port
c - Edge of water port (area to apply sealant)

Description		Where Used	Part Number
A	Perfect Seal	Edge of water ports	92-34227-1

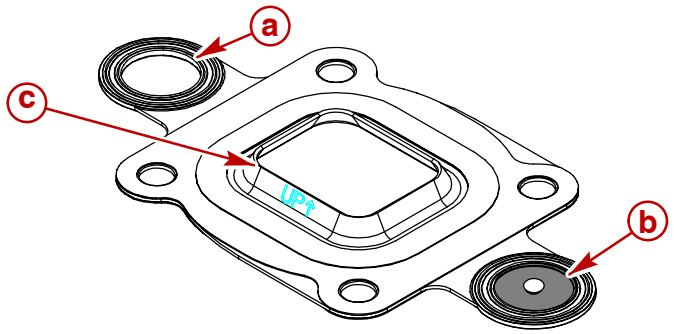
Gasket Application

Restrictor Gasket

IMPORTANT: Restrictor gasket must be used on all SEAWATER COOLED engines.

IMPORTANT: On engines without risers, the restrictor gasket must be placed between the exhaust manifold and the exhaust elbow.

IMPORTANT: The restrictor end of the gasket must be positioned to the seawater inlet side of the exhaust elbow.



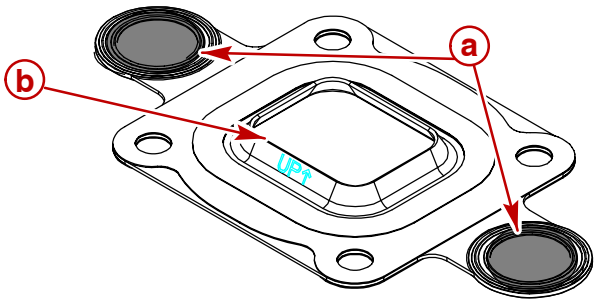
78805

a - Full flow passage
b - Restricted flow passage
c - Turbulator oriented up

Block Off Gasket

IMPORTANT: Block off gasket must be used on all CLOSED COOLED engines.

IMPORTANT: On engines without risers, the block off gasket must be placed between the exhaust manifold and the exhaust elbow.



78806

a - No opening for coolant flow
b - Turbulator oriented up

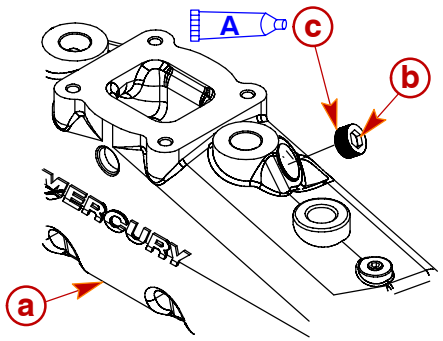
Installation

⚠ CAUTION

Avoid severe engine damage. The correct turbulator gasket MUST BE properly installed to avoid overheating due to insufficient water flow or coolant loss through exhaust.

IMPORTANT: Refer to Section 7B - Cold Risers and Section 7C - Warm Risers if exhaust risers are used.

1. **Seawater cooled models:** Apply sealant to threads of pipe plug and install to exhaust manifold.



78887

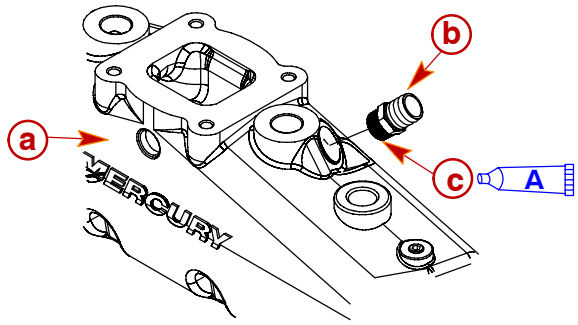
a - Exhaust manifold
b - Pipe plug
c - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Pipe plug	92-804874

2. Torque pipe plug.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow pipe plug	50		37

3. **Closed cooled models:** Apply sealant to threads of hose fitting and install to exhaust manifold.



78887

a - Exhaust manifold
b - Hose fitting
c - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Hose fitting	92-804874

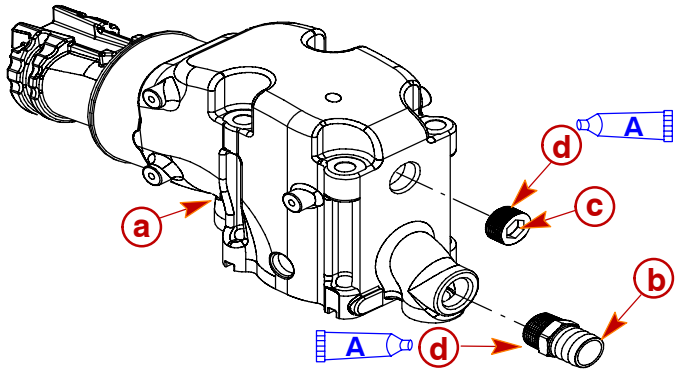
4. Torque hose fitting.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow pipe plug	50		37

5. Using new exhaust manifold gasket, install exhaust manifold to cylinder head. Torque fasteners.

Description	Nm	lb-in.	lb-ft
Exhaust manifold to cylinder head bolt	43		32

6. Apply sealant to threads of hose fitting and pipe plug and install in exhaust elbow.



78893

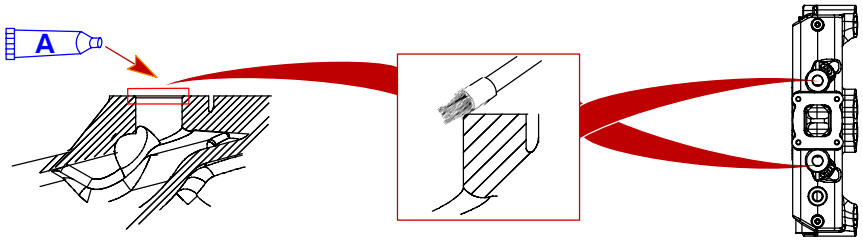
a - Exhaust elbow
b - Hose fitting
c - Pipe plug
d - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Hose fitting and pipe plug	92-804874

7. Torque hose fitting and pipe plug.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow pipe plug	50		37

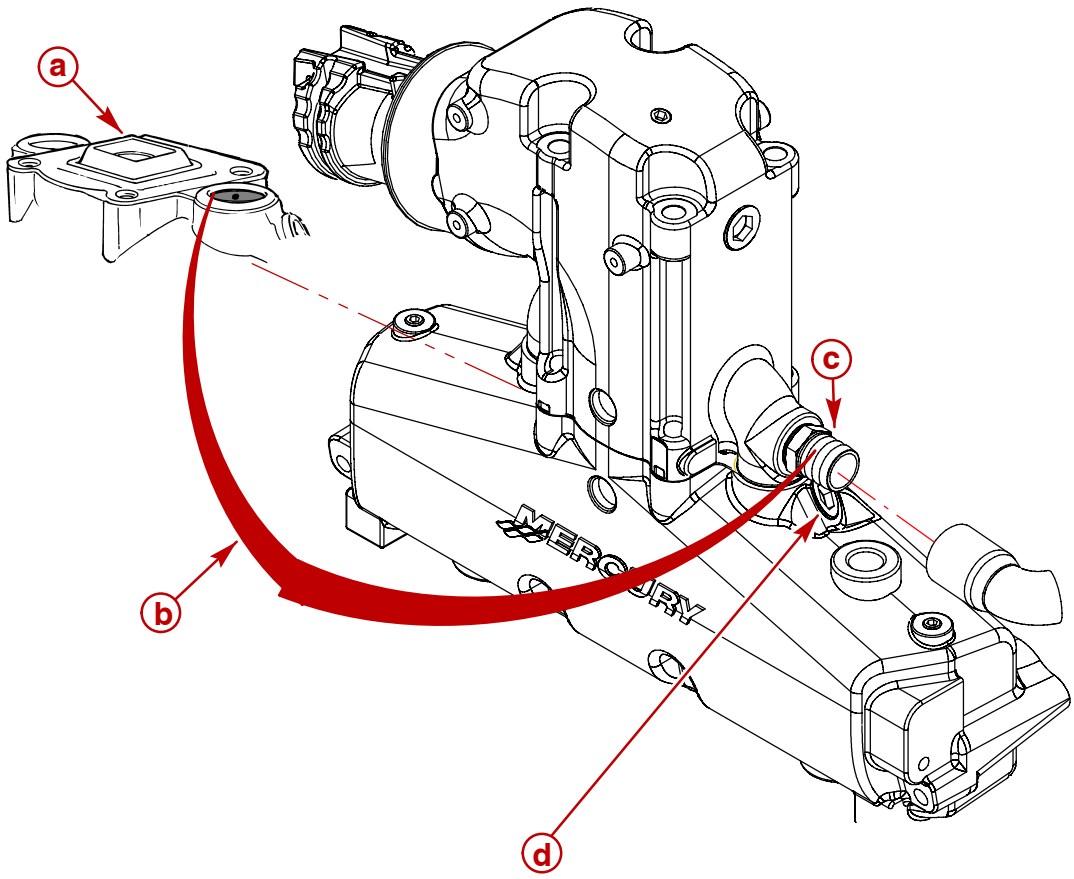
8. Apply sealant to the edge of each of the 2 water ports located on the exhaust manifold.



78807

Description		Where Used	Part Number
A	Quicksilver Perfect Seal	Edge of water ports	92-34227-1

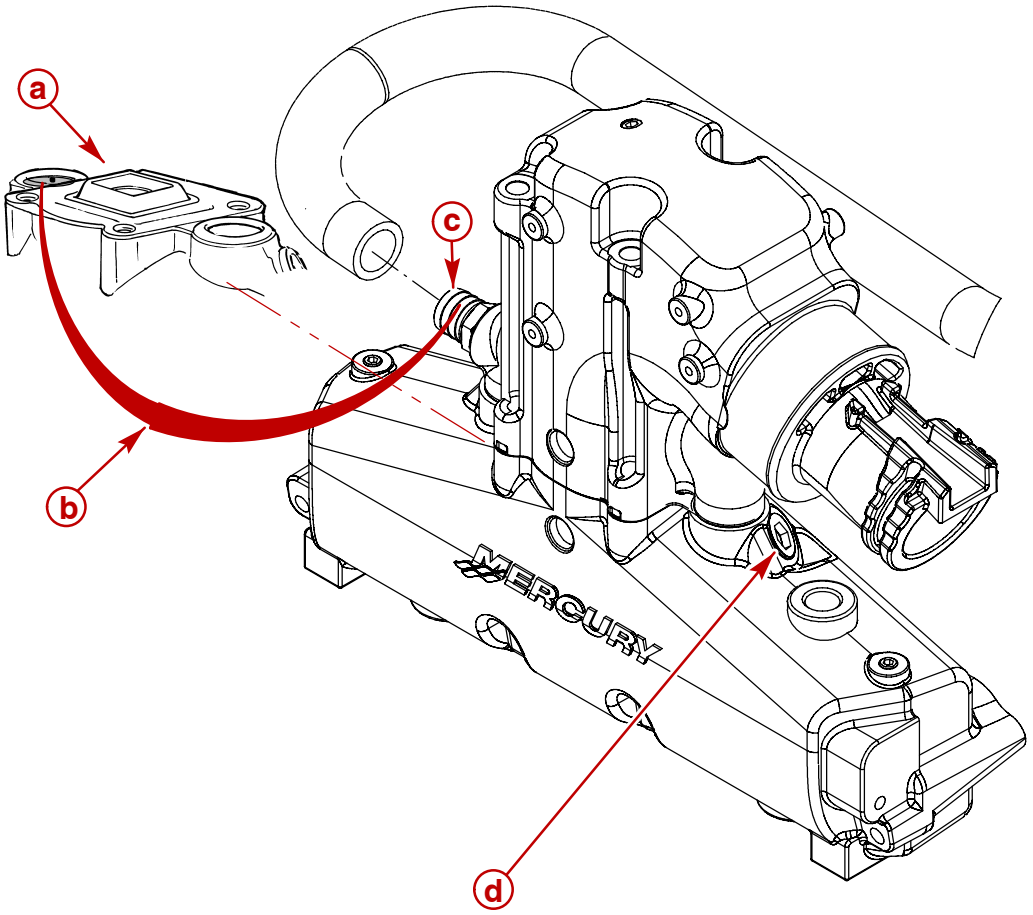
9. **Seawater cooled models :** Place the restrictor gasket on the exhaust manifold with the side marked “UP” visible. Ensure that the restricted water port of restrictor gasket is on the same side as the hose fitting of the exhaust elbow.



78910

MCM and MIE Inline exhaust seawater cooled model

- **a -** Restrictor gasket positioned between exhaust manifold and exhaust elbow
- **b -** Restricted water port of gasket is in line with hose fitting of exhaust elbow
- **c -** Exhaust elbow inlet water port with hose fitting
- **d -** Exhaust manifold outlet water port with pipe plug

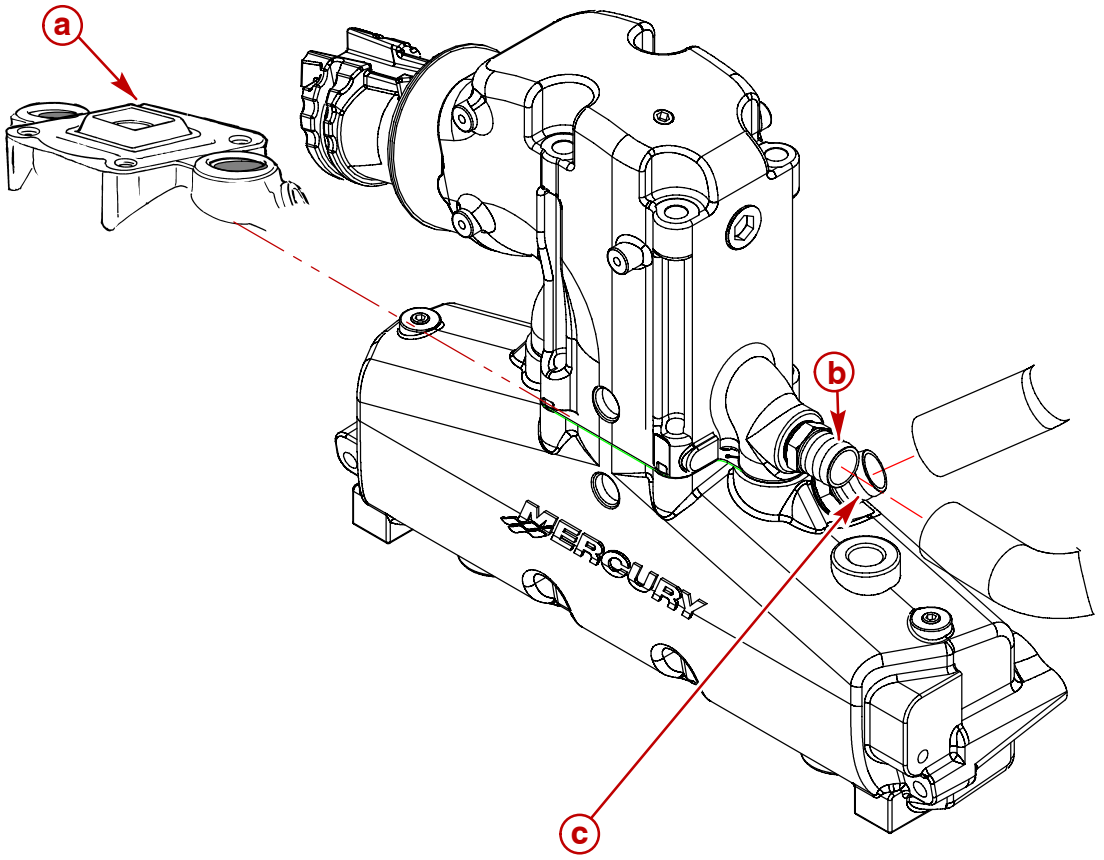


78889

MIE V-drive seawater cooled model

a - Restrictor gasket positioned between exhaust manifold and exhaust elbow
b - Restricted water port of gasket is in line with hose fitting of exhaust elbow
c - Exhaust elbow inlet water port with hose fitting
d - Exhaust manifold outlet water port with pipe plug

10. **Closed cooled models:** Place the block-off gasket on the exhaust manifold with the side marked “UP” visible.

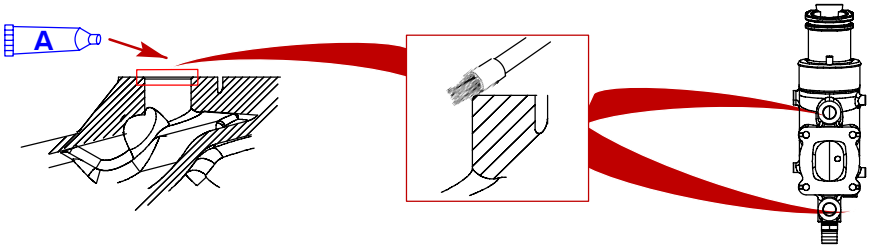


78890

MCM and MIE Inline exhaust closed cooled model

a - Block-off gasket positioned between exhaust manifold and exhaust elbow
b - Exhaust elbow inlet water port with hose fitting
c - Exhaust manifold outlet coolant port with hose fitting

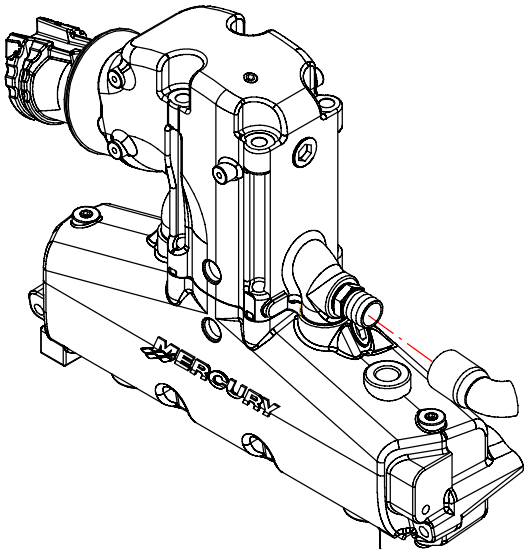
11. Apply sealant to the edge of each of the 2 water ports located on the exhaust elbow.



78807

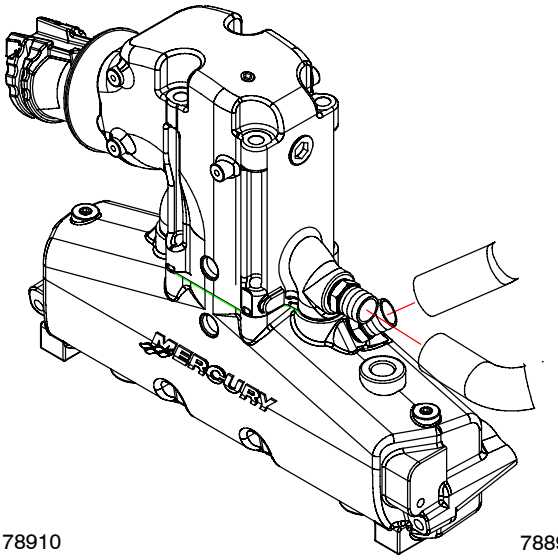
Description		Where Used	Part Number
A	Quicksilver Perfect Seal	Edge of water ports	92-34227-1

12. Place the exhaust elbow on the exhaust manifold as shown.



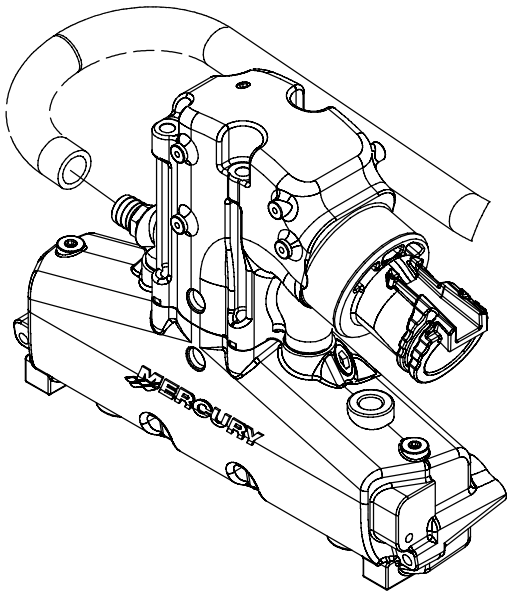
78910

Seawater cooled inline exhaust model



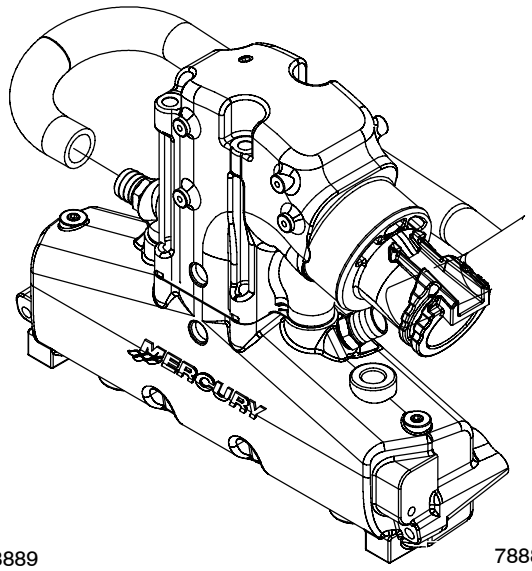
78890

Closed cooled inline exhaust model



78889

Seawater cooled V-drive model



78888

Closed cooled V-drive model

IMPORTANT: The 7-1/2 in. (190.5 mm) long, 9 in. (228.6 mm) long, and 10-1/2 in. (266.7 mm) long exhaust elbow screws require that a specific flat washer be used in conjunction with the screw. Refer to "*Mercury Precision Parts/Quicksilver Accessories Guide.*"

13. If applicable, assemble washers to the exhaust elbow screws.
14. Apply sealant to exhaust elbow screw threads and hand-start to temporarily secure the assembly.

Description	Where Used	Part Number
Quicksilver Perfect Seal	Edge of water ports	92-34227-1

15. Align the exhaust elbow to the engine exhaust system.

NOTE: *Gasket is not reusable. Inspect for proper gasket and component position before torquing.*

16. Torque the exhaust elbow fasteners.

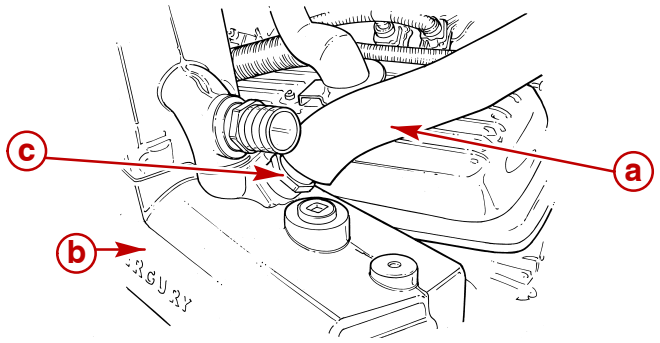
Description		Nm	lb-in.	lb-ft
Exhaust elbow to exhaust manifold screws				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45

17. **Seawater cooled models:** Connect the engine water hoses to the exhaust elbows and tighten hose clamps securely.

⚠ CAUTION

Avoid severe engine damage due to improper hose connection, causing coolant to discard out exhaust. DO NOT connect the engine coolant hose to the exhaust elbow.

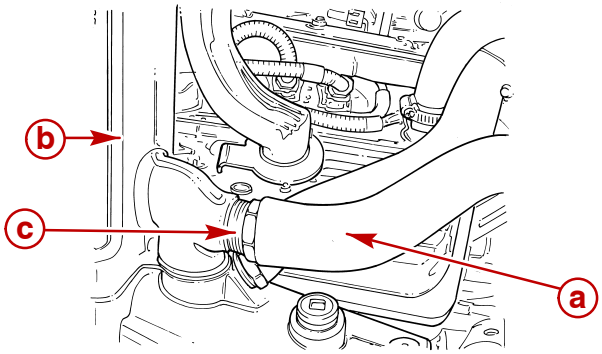
18. **Closed cooling models:** Connect the engine coolant hose from the thermostat housing to the hose fitting of the top of the exhaust manifold. Tighten hose clamps securely.



78758

a - Engine coolant hose
b - Exhaust manifold
c - Hose fitting of the exhaust manifold

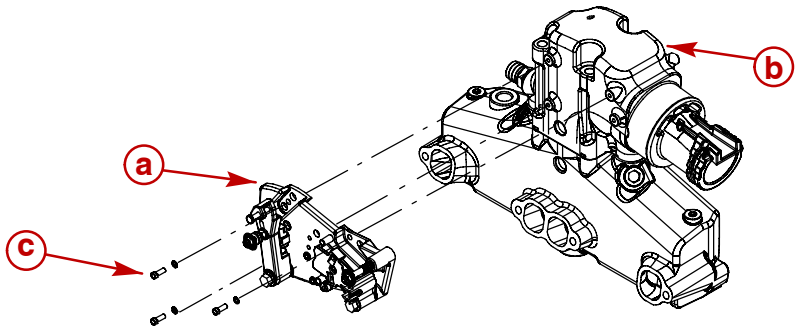
19. **Closed cooling models:** Connect the engine water hose from the heat exchanger to the exhaust elbow and tighten hose clamps securely.



78759

a - Engine water hose
b - Exhaust elbow
c - Hose fitting of the exhaust elbow

20. **MCM models:** Install shift plate assembly on exhaust elbow.

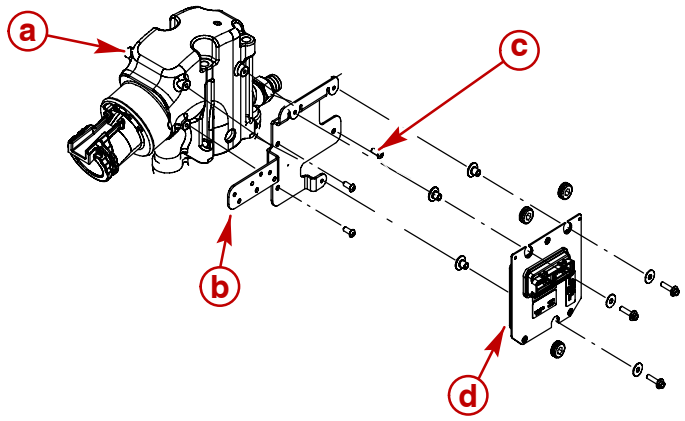


78788

a - Exhaust elbow
b - Shift bracket
c - Shift bracket to exhaust elbow screw

21. **MCM models:** Connect both shift cables.

22. Install ECM and ECM bracket on exhaust elbow.



78685

a - Exhaust elbow
b - ECM bracket
c - Screw, short
d - ECM

23. Secure the engine exhaust system.
24. Install any additional components removed during disassembly.
25. **Closed cooled models:** Fill closed cooling system to operating level. Refer to Section 6C - Closed Cooled Models.
26. Reconnect the battery cables to the battery. Tighten securely.

⚠ CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

27. Supply cooling water to the engine.
28. Start the engine and check for exhaust and water leaks.

EXHAUST SYSTEM

Section 7C - Cold Riser Models

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7 C

General Information

This section contains new components and procedures. Before attempting repairs or tune-up, it is suggested that the procedure first be read through to gain knowledge of the methods and tools used and the cautions and warnings required for safety.

Torque Specifications

NOTE: *Securely tighten all fasteners not listed below.*

Description		Nm	lb-in.	lb-ft
Exhaust elbow to riser and riser to exhaust manifold screw				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45
Exhaust manifold and exhaust elbow pipe plug		50		37
Exhaust manifold and exhaust elbow hose fitting		50		37

Lubricants / Sealants / Adhesives

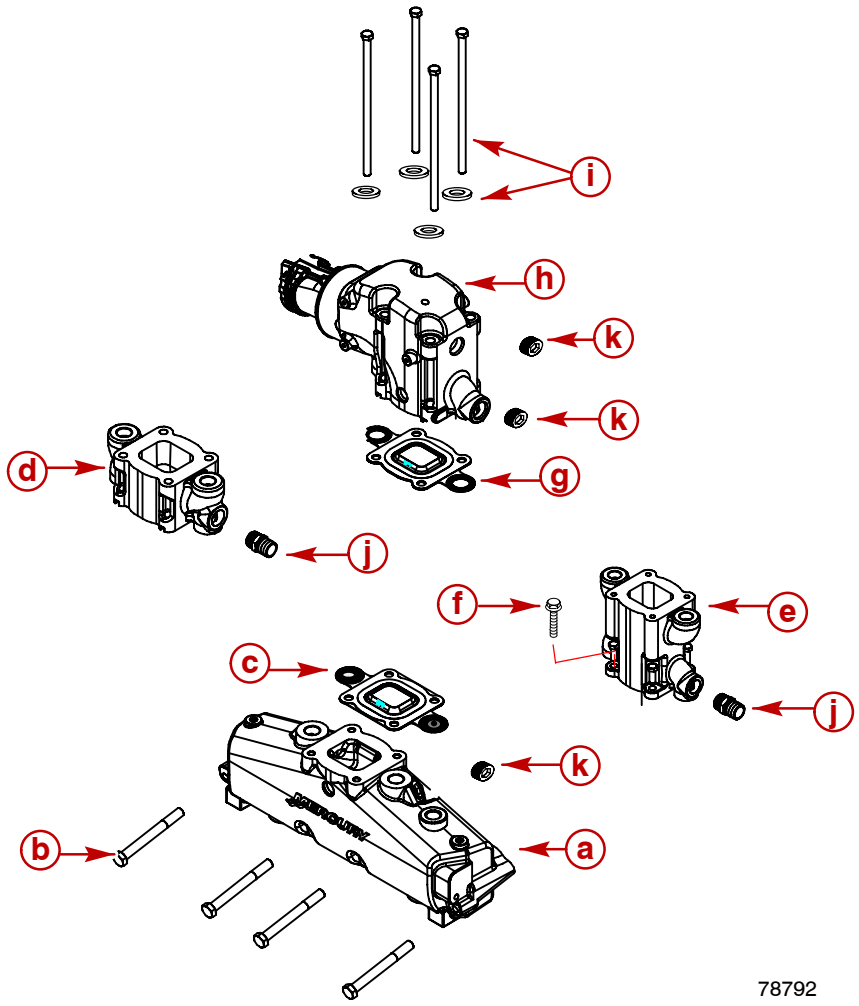
Description	Where Used	Part Number
Quicksilver Perfect Seal	Water ports on the exhaust manifold, riser, and exhaust elbow	92-34227-1
	Screw threads	
Loctite 567 Pipe Sealant	Hose fitting and pipe plug	92-804874

Serial Number Breaks

V-8 Models With Cold Risers	Serial Number
Sterndrive (MCM) Models	0M600000 through 0M614999
Inboard and Tow Sports (MIE) Models	0M317000 through 0M389999

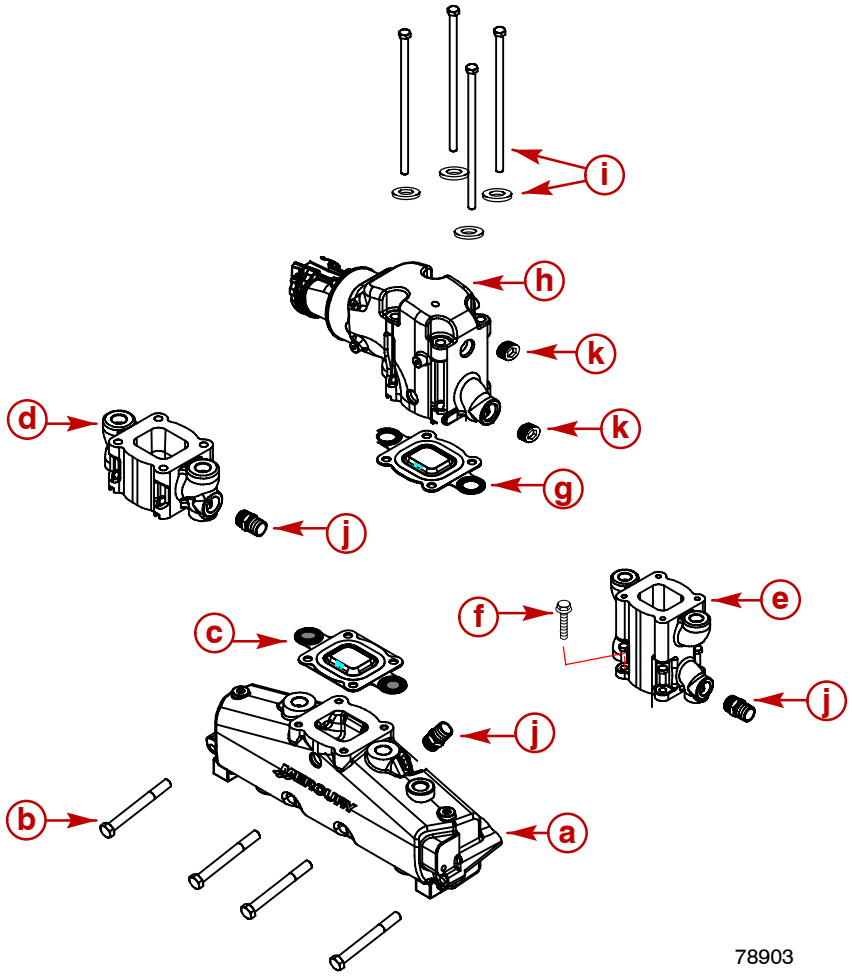
Exploded View

Seawater Cooled Models



a - Exhaust manifold
b - Manifold-to-cylinder head bolt (4)
c - Restrictor gasket, with turbulator (seawater cooled models)
d - 76 mm (3 in.) cold riser
e - 152 mm (6 in.) cold riser
f - Riser to exhaust manifold screw (4)
g - Full flow gasket, with turbulator
h - Exhaust elbow
i - Exhaust elbow to riser or exhaust manifold screw and washer (4 each)
j - Hose fitting
k - Pipe plug

Closed Cooled Models



a - Exhaust manifold
b - Manifold-to-cylinder head bolt 4)
c - Block off gasket, with turbulator (closed cooled models)
d - 76 mm (3 in.) cold riser
e - 152 mm (6 in.) cold riser
f - Riser to exhaust manifold screw (4)
g - Full flow gasket, with turbulator
h - Exhaust elbow
i - Exhaust elbow to riser or exhaust manifold screw and washer (4 each)
j - Hose fitting
k - Pipe plug

Removal

⚠ WARNING

Avoid injury or death and power package damage from an electrical shock, fire or explosion. Always disconnect both battery cables from the battery before servicing the power package.

1. Disconnect both battery cables from the battery.

⚠ CAUTION

Avoid severe engine damage. Exhaust elbows and manifolds MUST BE drained to prevent coolant / water from entering combustion chambers when exhaust elbows are removed.

1. **Seawater cooled models:** Drain the seawater section of the engine.
1. **Closed cooled models:** Drain the coolant section of the engine. Refer to Section 6C.
2. Disconnect the engine exhaust hoses. Retain fasteners.
3. Disconnect all hoses from the exhaust manifold, riser, and exhaust elbow. Retain fasteners.
4. Remove and retain any items or components that are mounted to the exhaust manifold, riser, and the exhaust elbow of the engine.
5. Remove the exhaust elbow and riser. Retain fasteners.
6. Remove the exhaust manifold. Retain fasteners.
7. Discard used gaskets.

Cleaning And Inspection

1. Clean the gasket material from all surfaces and wash the parts in solvent.
2. Inspect the water passages for foreign material. The passages must be clean for efficient cooling.

NOTE: *If more thorough inspection is desired, the pipe plugs may be removed from the exhaust manifold and the exhaust elbow.*

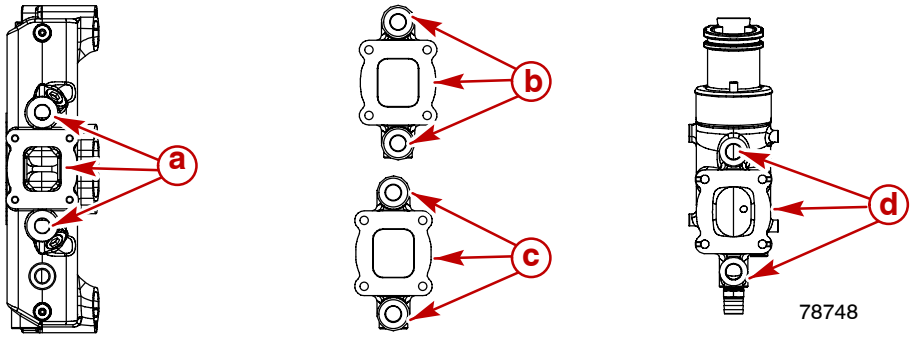
IMPORTANT: If the pipe plugs are removed, coat the threads with sealant before reinstalling.

Description	Where Used	Part Number
Loctite 567 Pipe Sealant	Pipe plug	92-804874

3. Inspect the manifold, elbow, and riser for cracks.
4. Inspect all parts carefully. Machined surfaces must be clean and free of all marks and deep scratches or water and exhaust leaks may result.
5. Inspect for damaged metal caused by saltwater or exhaust gas corrosion in the manifold, elbow, and riser.

IMPORTANT: If bare metal is present on the gasket sealing surface, Perfect Seal should be applied to that area before assembly.

6. Measure the surface flatness of all gasket surfaces on the manifold, elbow, and riser.



a - Exhaust manifold gasket sealing surface
b - Riser gasket sealing surface on top side
c - Riser gasket sealing surface on bottom side
d - Exhaust elbow gasket sealing surface

NOTE: *Only use this specification if the gasket surfaces on used exhaust components have to be machined to remove minor corrosion.*

Description		mm (in.)
Surface Flatness	Maximum overall difference	0.07 (0.003)

NOTE: *The maximum material that can be removed is 0.25 mm (0.010 in.). When torquing the attaching bolts, ensure that they are not contacting the bottom of the threaded hole in the manifold.*

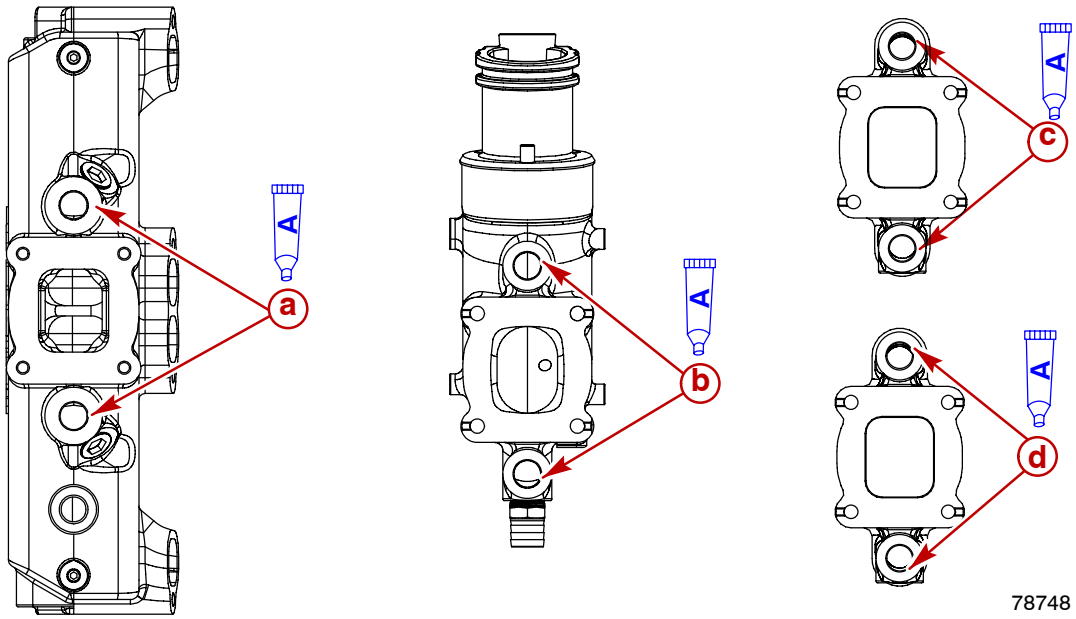
NOTE: *Gasket is not reusable. Inspect for proper gasket replacement before disassembly and assembly.*

7. Replace all damaged components.

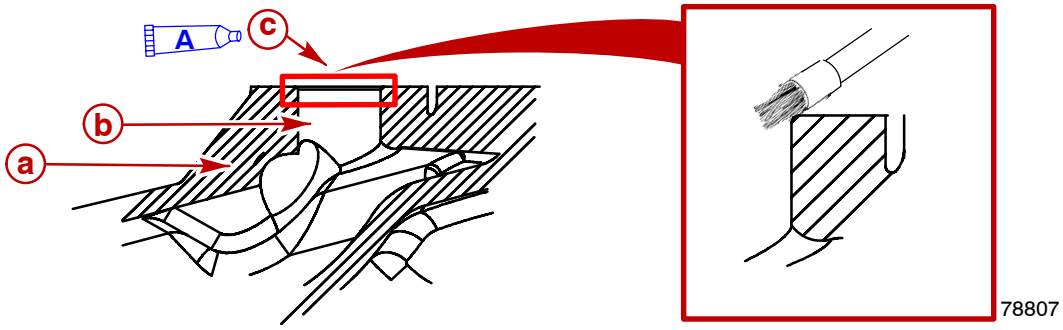
Reassembly

IMPORTANT: The edge of the water ports on all cast iron parts must be coated with Perfect Seal during assembly.

1. If exhaust elbow assembly is disassembled or risers are added, apply sealant to edge of all water ports (exhaust manifold, both sides of the riser, and exhaust elbow).



a - Exhaust manifold water port sealing surface
b - Exhaust elbow water port sealing surface
c - Riser water port sealing surface on top side
d - Riser water port sealing surface on bottom side



a - Exhaust manifold (cross section)
b - Exhaust manifold water port
c - Edge of water port (area to apply sealant)

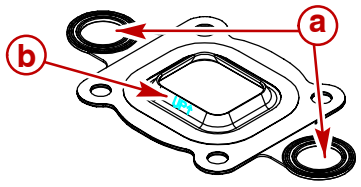
Description		Where Used	Part Number
A	Perfect Seal	Edge of water ports	92-34227-1

Gasket Application

Full Flow Gasket

IMPORTANT: Full flow gasket is used on engines with risers.

IMPORTANT: On cold riser models, the full flow gasket must be placed between riser and exhaust elbow.



78804

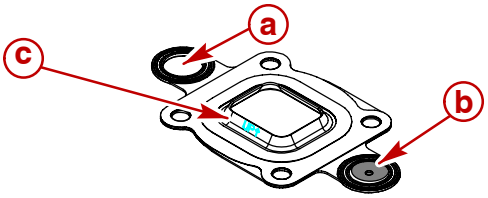
a - Passages fully open
b - Turbulator oriented up

Restrictor Gasket

IMPORTANT: Restrictor gasket must be used on all SEAWATER COOLED engines.

IMPORTANT: On cold riser models, the restrictor gasket must be placed between the exhaust manifold and the riser.

IMPORTANT: The restrictor end of the gasket must be positioned to the seawater inlet side of the exhaust elbow.



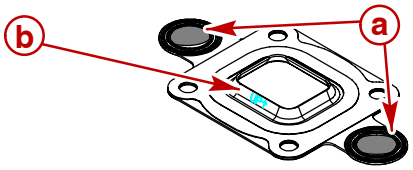
78805

a - Full flow passage
b - Restricted flow passage
c - Turbulator oriented up

Block-Off Gasket

IMPORTANT: Block off gasket must be used on all CLOSED COOLED engines.

IMPORTANT: On cold riser models, the block off gasket must be placed between the exhaust manifold and the riser.



78806

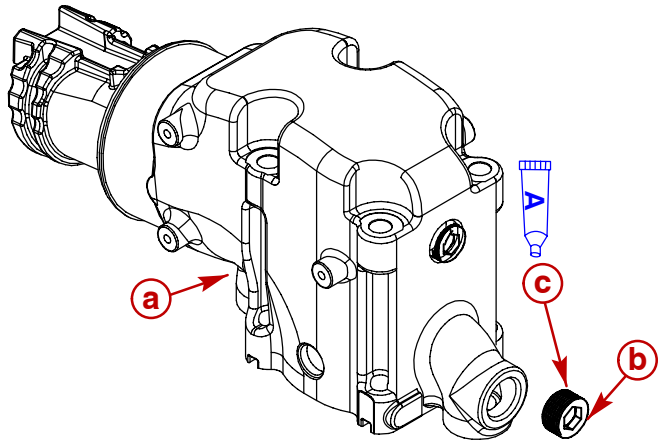
a - No opening for water flow
b - Turbulator oriented up

Installation

⚠ CAUTION

Avoid severe engine damage. The correct turbulator gasket MUST BE properly installed to avoid overheating due to insufficient water flow or coolant loss through exhaust.

1. Apply sealant to the threads of the pipe plug and install into the exhaust elbows.



78893

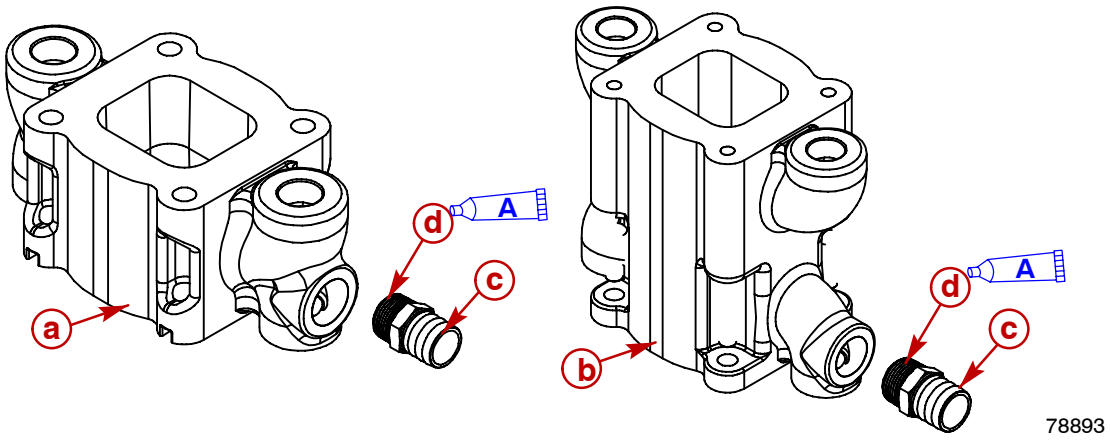
a - Exhaust elbow
b - Pipe plug
c - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Hose Fitting	92-804874

2. Torque pipe plug.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow pipe plug	50		37

3. Apply sealant to the threads of the hose fitting and install into the risers.



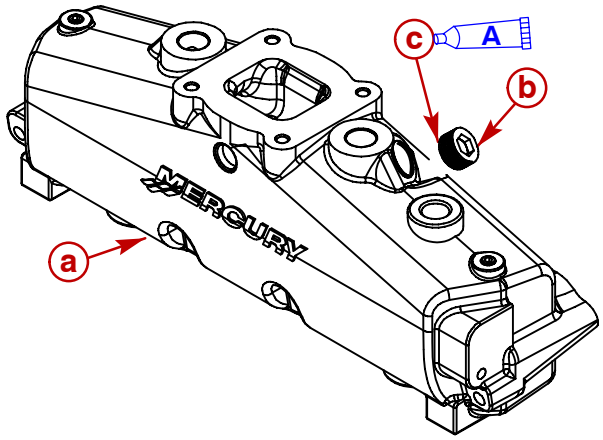
a - 76 mm (3 in.) riser
b - 152 mm (6 in.) riser
c - Hose fitting
d - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Hose fitting	92-804874

4. Torque hose fitting.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow hose fitting	50		37

5. **Seawater cooled models:** Apply sealant to the threads of the pipe plug and install into the exhaust manifold.



78893

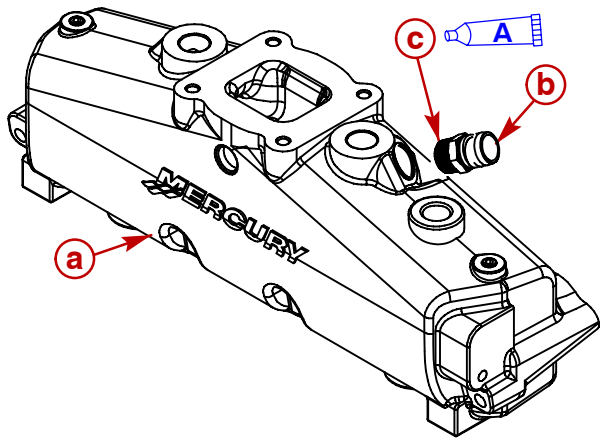
a - Exhaust manifold
b - Pipe plug
c - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Hose fitting	92-804874

6. Torque pipe plug.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow pipe plug	50		37

7. **Closed cooled models:** Apply sealant to the threads of the hose fitting and install into the exhaust manifold.



78893

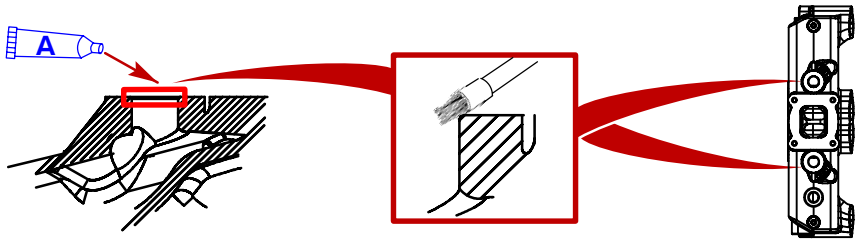
a - Exhaust manifold
b - Hose fitting
c - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	hose fitting	92-804874

8. Torque hose fitting.

Description	Nm	lb-in.	lb-ft
Exhaust manifold and exhaust elbow hose fitting	50		37

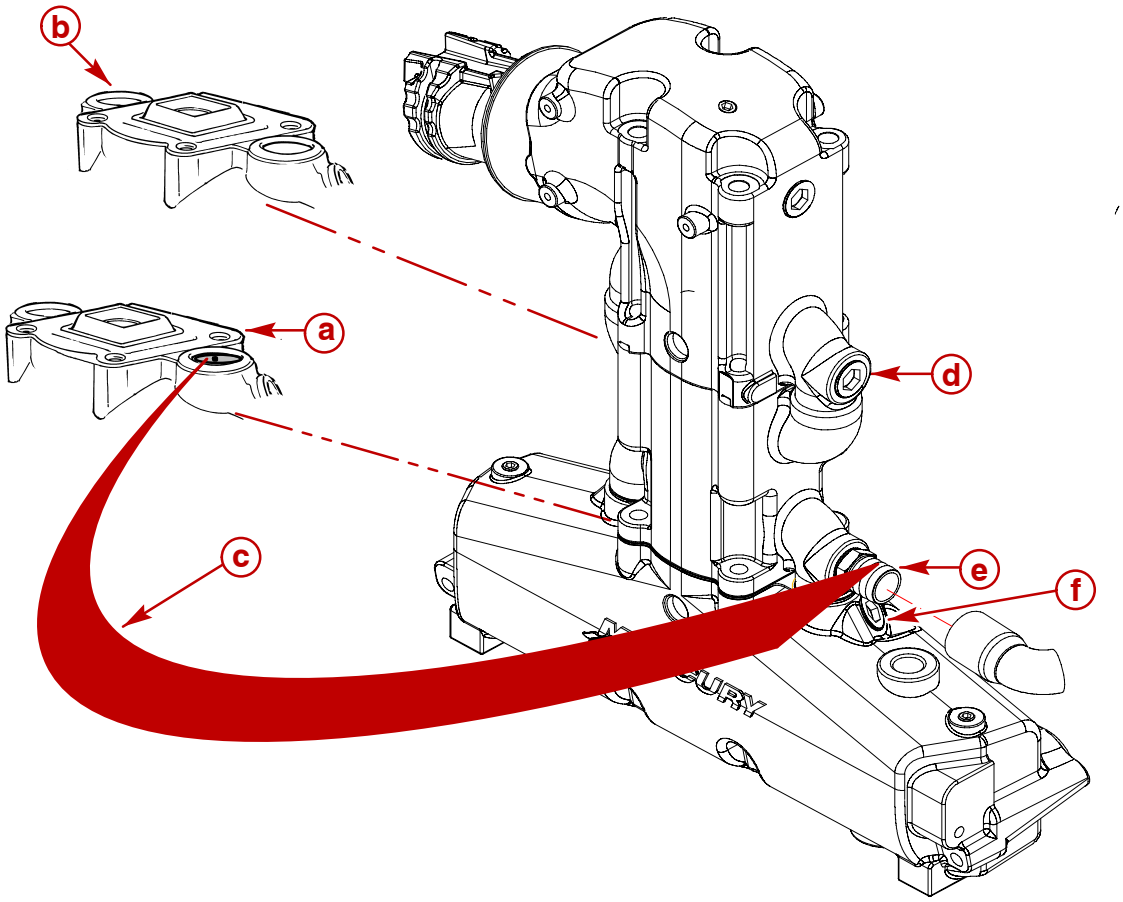
9. Apply sealant to the edge of each of the 2 water ports located on the exhaust manifold.



78807

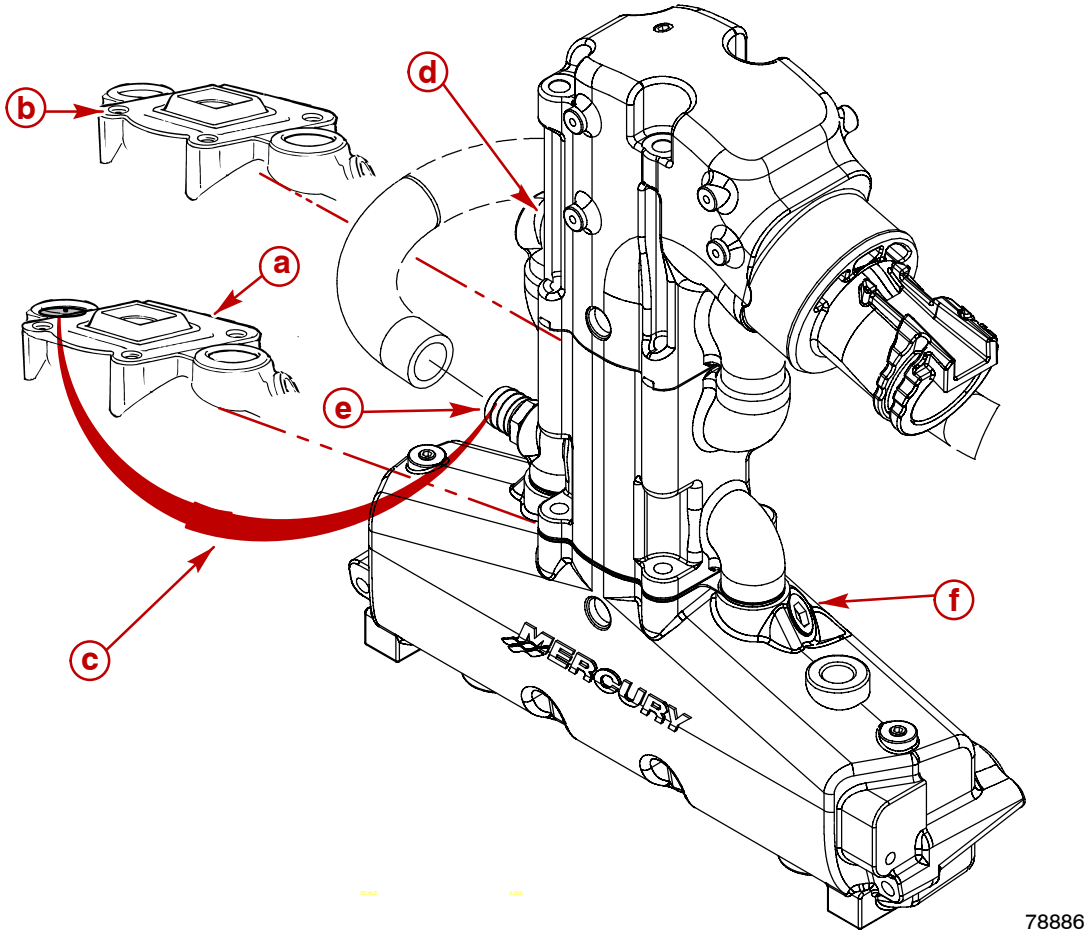
Description		Where Used	Part Number
A	Quicksilver Perfect Seal	Edge of water ports	92-34227-1

10. **For seawater cooled models only:** Place the restrictor gasket on the exhaust manifold with the side marked “UP” visible. Ensure that the restricted water port of restrictor gasket is on the same side as the hose fitting of the riser.



MCM and MIE inline exhaust seawater cooled model

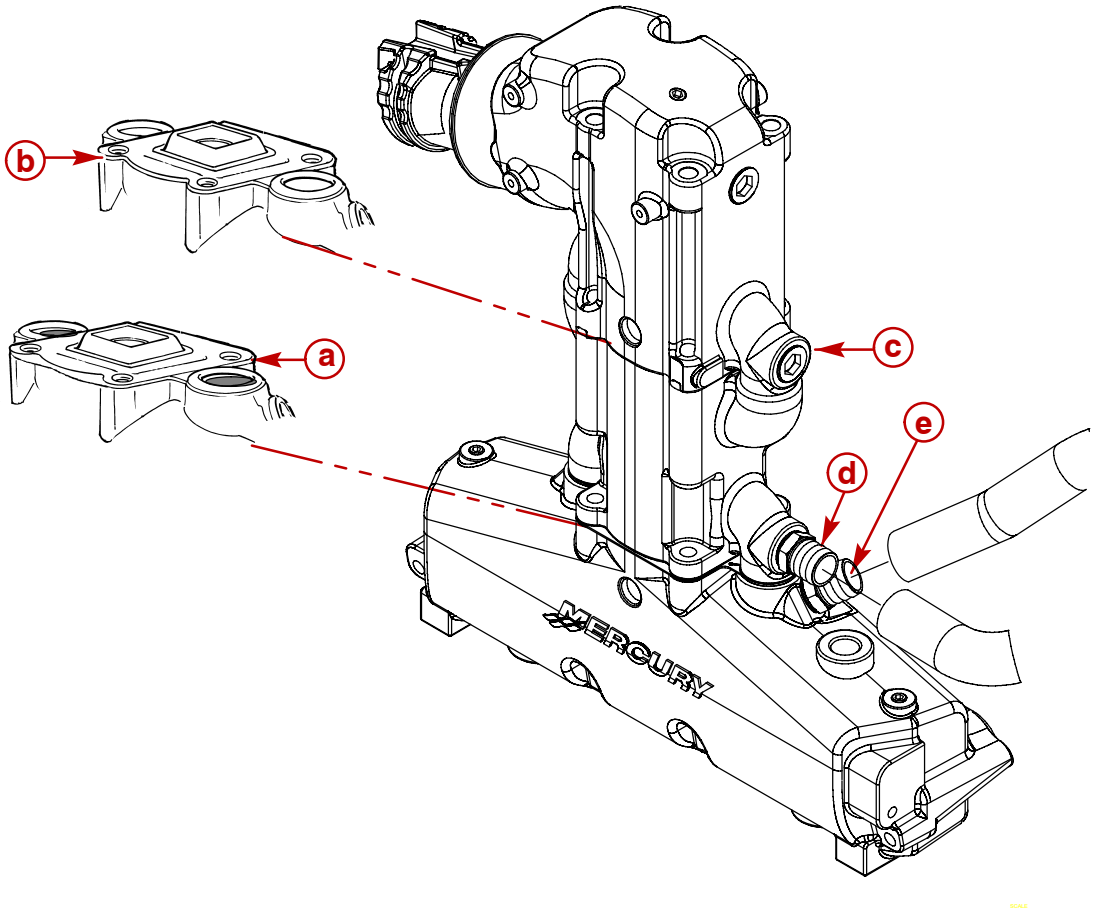
- **a** - Restrictor gasket positioned between exhaust manifold and riser
- **b** - Full flow gasket positioned between riser and exhaust elbow
- **c** - Restricted water port of gasket is in line with hose fitting of riser
- **d** - Exhaust elbow inlet water port with pipe plug
- **e** - Riser inlet water port with hose fitting
- **f** - Exhaust manifold outlet water port with pipe plug



MIE V-drive seawater cooled model

- **a** - Restrictor gasket positioned between exhaust manifold and riser
- **b** - Full flow gasket positioned between riser and exhaust elbow
- **c** - Restricted water port of gasket is in line with hose fitting of riser
- **d** - Exhaust elbow inlet water port with pipe plug
- **e** - Riser inlet water port with hose fitting
- **f** - Exhaust manifold outlet water port with pipe plug

11. **For closed cooled models only:** Place the block-off gasket on the exhaust manifold with the side marked “UP” visible.

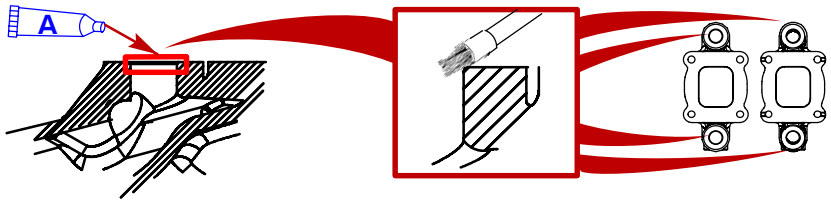


78891

MCM and MIE inline exhaust closed cooled model

- **a** - Block off gasket positioned between exhaust manifold and riser
- **b** - Full flow gasket positioned between riser and exhaust elbow
- **c** - Exhaust elbow inlet water port with pipe plug
- **d** - Riser inlet water port with hose fitting
- **e** - Exhaust manifold outlet water port with hose fitting

12. Apply sealant to the edge of each of the 4 water ports located on the riser.



78807

Description		Where Used	Part Number
A	Quicksilver Perfect Seal	Edge of water ports	92-34227-1

13. Place the riser on the exhaust manifold. Refer to exploded view preceding for correct placement.

NOTE: *Position of the riser water port is placed closest to exhaust manifold.*

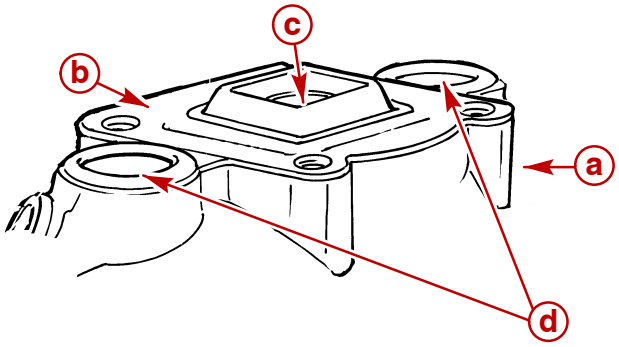
IMPORTANT: Ensure that the hose fitting located in the riser water port is positioned to accept the engine water hose.

14. **For 152 mm (6 inch) riser:** Install and hand-tighten 4 screws, 3/8-16 x 1.00 in. (25 mm) long, to temporarily secure the riser and gasket to the exhaust manifold.

⚠ CAUTION

Avoid severe engine damage. The turbulator gasket MUST BE properly installed to avoid overheating due to insufficient water flow or coolant loss through exhaust.

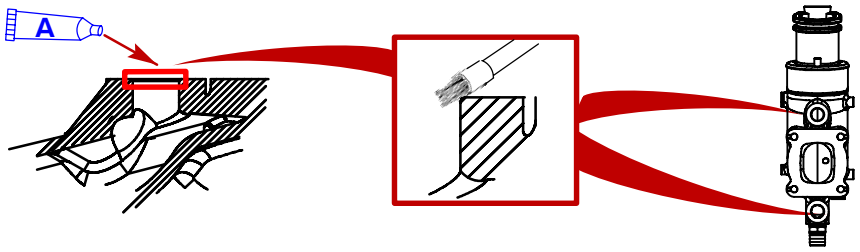
15. Place the full flow gasket on the riser with the side marked “UP” visible.



78485

a - Exhaust manifold
b - Full flow gasket
c - Turbulator oriented up
d - Passages fully open

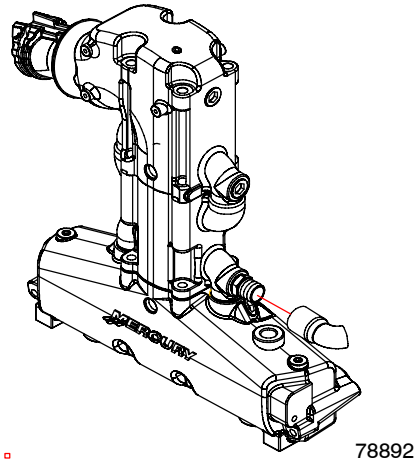
16. Apply sealant to the edge of each of the 2 water ports located on the exhaust elbow.



78807

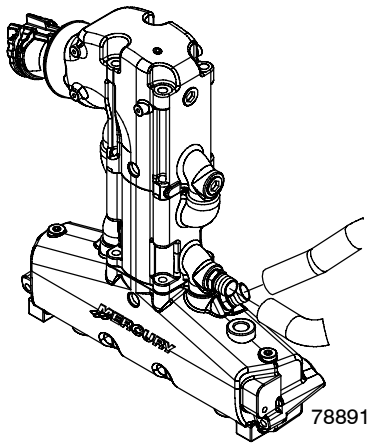
Description		Where Used	Part Number
A	Quicksilver Perfect Seal	Edge of water ports	92-34227-1

17. Place the exhaust elbow on the riser as shown.



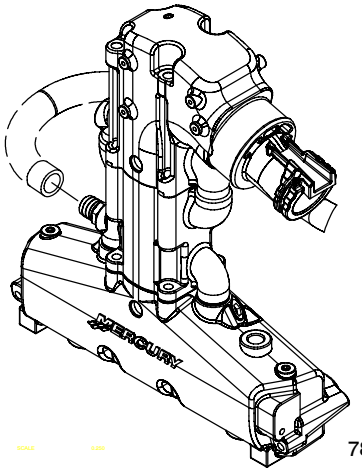
78892

Seawater cooled 152 mm (6 in.) riser



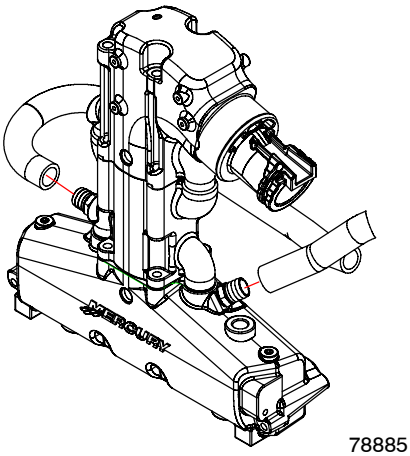
78891

Closed cooled 152 mm (6 in.) riser



78886

Seawater cooled V-drive 152 mm (6 in.) riser



78885

Closed cooled V-drive 152 mm (6 in.) riser

IMPORTANT: The 7-1/2 in. (190.5 mm), 9 in. (228.6 mm) long and 10-1/2 in. (266.7mm) exhaust elbow screws require that a specific flat washer be used in conjunction with the screw. Refer to "*Mercury Precision Parts/Quicksilver Accessories Guide*".

18. If applicable, assemble washers to the exhaust elbow screws.
19. Apply sealant to exhaust elbow screw threads and hand-start to temporarily secure the assembly.

Description	Where Used	Part Number
Quicksilver Perfect Seal	Screw threads	92-34227-1

20. Align the exhaust elbow to the intermediate elbow or engine exhaust system.
21. **For 152 mm (6 inch) riser:** Tighten and torque screws holding the riser to the exhaust manifold.

NOTE: *Gasket is not reusable. Inspect for proper gasket and component position before torquing.*

Description		Nm	lb-in.	lb-ft
Exhaust elbow and riser to exhaust manifold screws				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45

22. If applicable, ensure that washers are in place between bolt and exhaust elbow.
23. Torque the exhaust elbow fasteners.

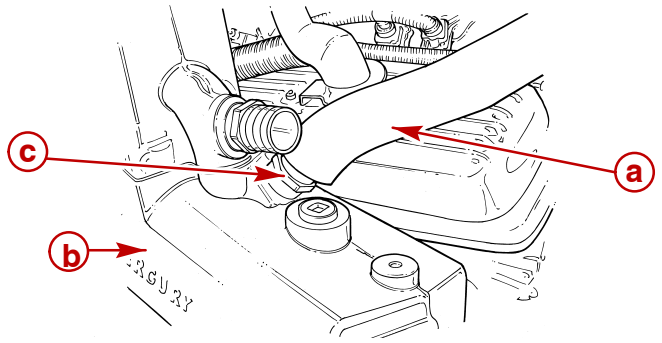
Description		Nm	lb-in.	lb-ft
Exhaust elbow and riser to exhaust manifold screw				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45

24. **Seawater cooled models:** Connect the engine water hoses to the hose fitting of riser and tighten hose clamps securely.

⚠ CAUTION

Avoid severe engine damage due to improper hose connection, causing coolant to discard out exhaust. Do NOT connect the engine coolant hose to the exhaust elbow.

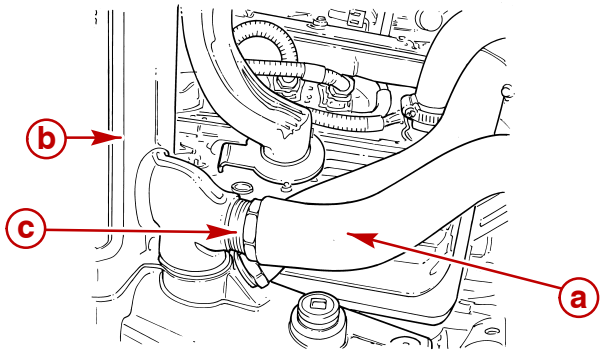
25. **Closed cooling models:** Connect the coolant hose from the thermostat housing to the hose fitting of the top of the exhaust manifold. Tighten hose clamps securely.



78758

a - Engine coolant hose
b - Exhaust manifold
c - Hose fitting of the exhaust manifold

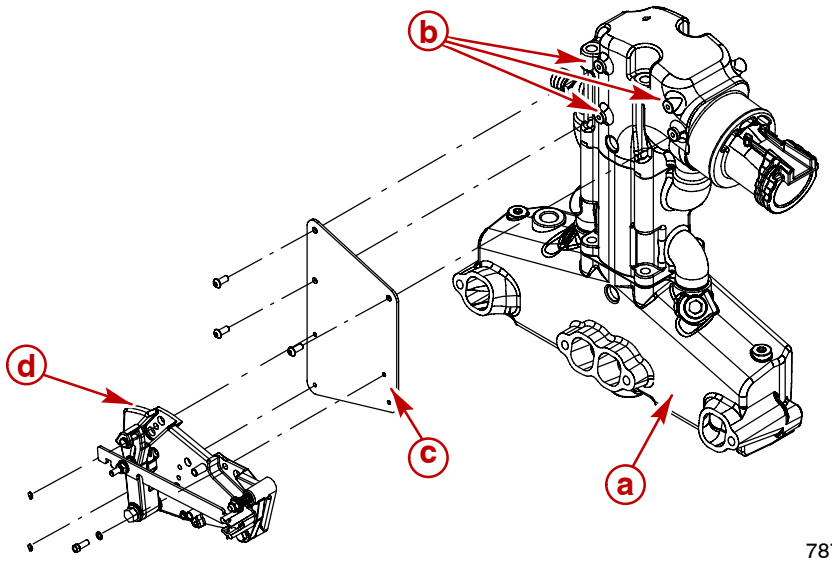
26. **Closed cooling models:** Connect the engine water hose from the heat exchanger to the exhaust riser and tighten hose clamps securely.



78759

a - Engine water hose
b - Exhaust elbow
c - Hose fitting of the riser

27. **Starboard exhaust elbow:** MCM only.
    a. For 152mm (6 in.) riser, install the drop down shift plate bracket.
    b. Install the shift plate assembly to the elbow.
    c. Tighten securely.

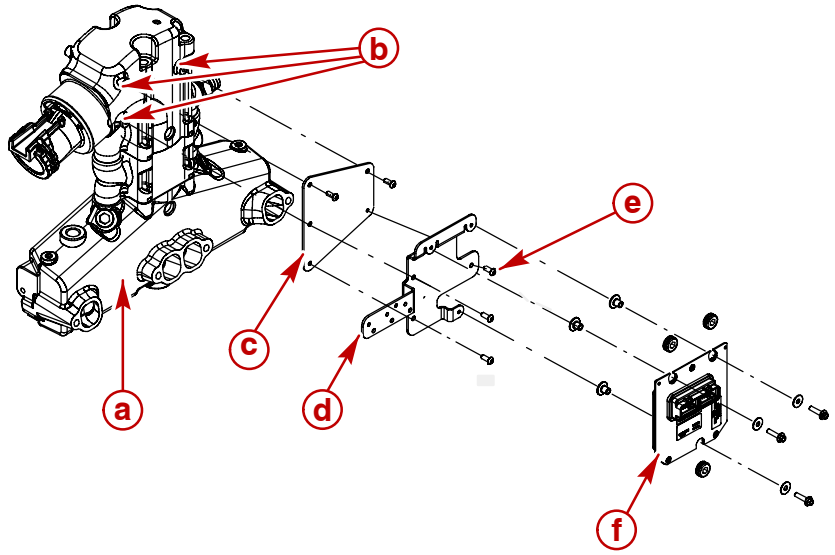


78788

Drop down bracket for the 152 mm (6 in.) riser assembly

a - Exhaust manifold, riser, elbow and assembly
b - Bracket mounting holes
c - Drop down bracket
d - Shift bracket

28. **Port exhaust elbow with 76 mm (3 in.) riser:** All models.
    a. Install the ECM drop-down bracket.
    b. Install the ECM bracket and the ECM to the exhaust elbow.
    c. Tighten securely.

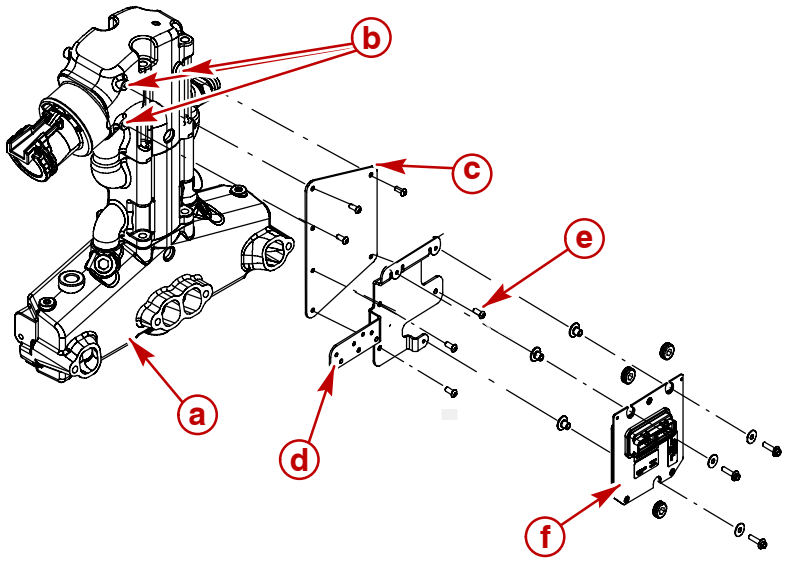


78787

Drop down bracket for the 76 mm (3 in.) riser assembly

- **a** - Exhaust manifold, riser, and elbow assembly
- **b** - Bracket mounting holes
- **c** - Drop down bracket
- **d** - ECM Bracket
- **e** - Short screw
- **f** - ECM

29. **Port exhaust elbow with 152 mm (6 in.) riser:** All models.
    a. Install the ECM drop-down bracket.
    b. Install the ECM bracket and the ECM to the exhaust elbow.
    c. Tighten securely.



78789

Drop down bracket for the 152 mm (6 in.) riser assembly

- **a** - Exhaust manifold, riser, and elbow assembly
- **b** - Bracket mounting holes
- **c** - Drop down bracket
- **d** - ECM bracket
- **e** - Short screw
- **f** - ECM

30. Secure the engine exhaust system.
31. Install any additional components removed during disassembly.
32. **Closed cooled models:** Refill closed cooling system to operating level.
33. Reconnect the battery cables to the battery. Tighten securely.

⚠ CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

34. Supply cooling water to the engine.
35. Start the engine and check for exhaust and water leaks.

EXHAUST SYSTEMS

Section 7D - Warm Riser Models

Table of Contents

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7 D

General Information

This section contains new components and procedures. Before attempting repairs or tune-up, it is suggested that the procedure first be read through to gain knowledge of the methods and tools used and the cautions and warnings required for safety.

Torque Specifications

NOTE: *Securely tighten all fasteners not listed below.*

Description		Nm	lb-in.	lb-ft
Screws, exhaust elbow to riser and riser to exhaust manifold				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45
Exhaust manifold and exhaust elbow pipe plug		50		37
Exhaust manifold and exhaust elbow hose fitting		50		37

Lubricants / Sealants / Adhesives

Description	Where Used	Part Number
Quicksilver Perfect Seal	Water ports on the exhaust manifold, riser, and exhaust elbow	92-34227-1
	Screw threads	
Loctite 567 Pipe Sealant	Hose fitting	92-804874

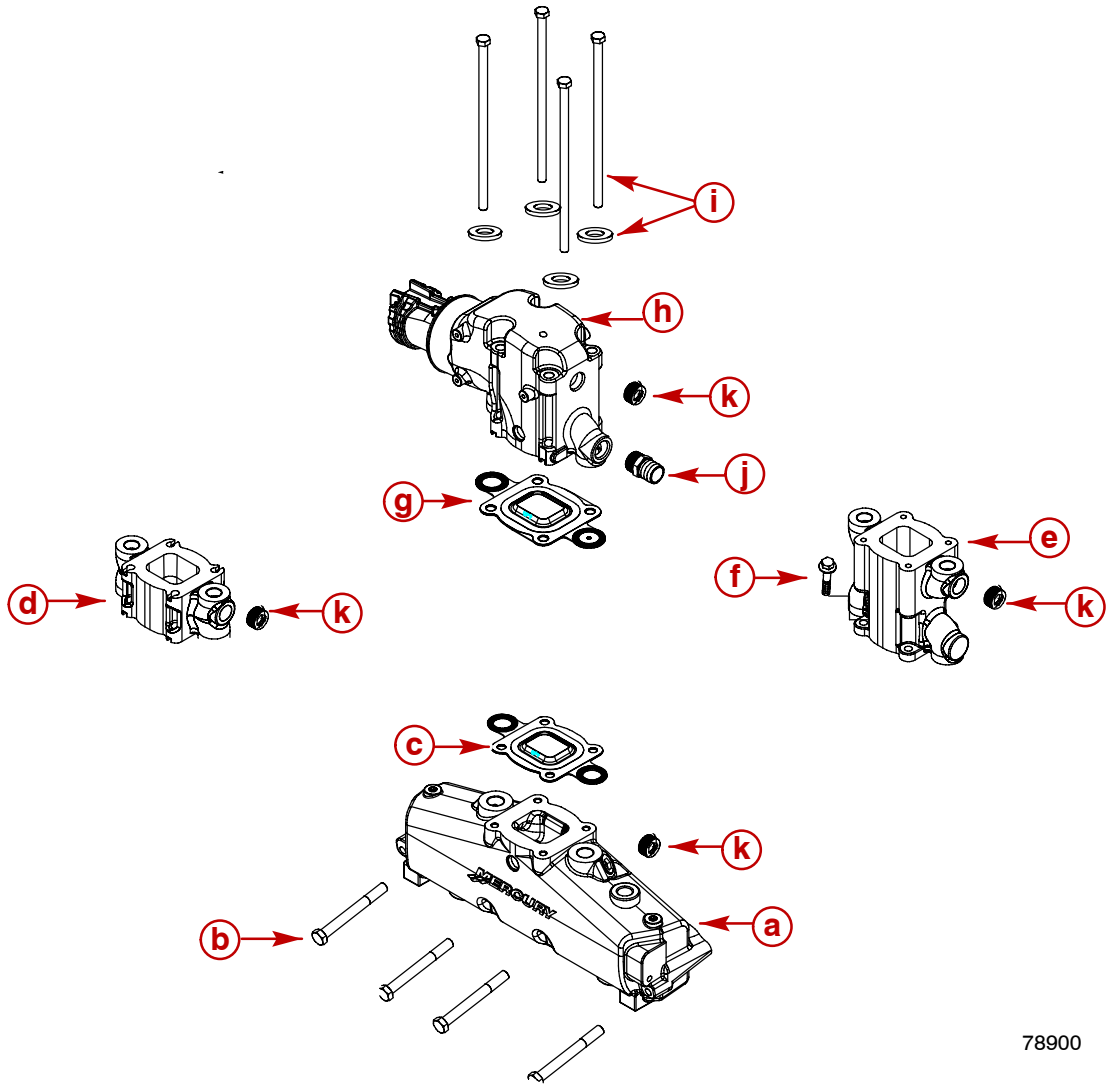
Serial Number Breaks

Models With Warm Risers	Serial Number
Sterndrive (MCM) Models	0M615000 And Above
Inboard and Tow Sports (MIE) Models	0M390000 And Above

Exploded View

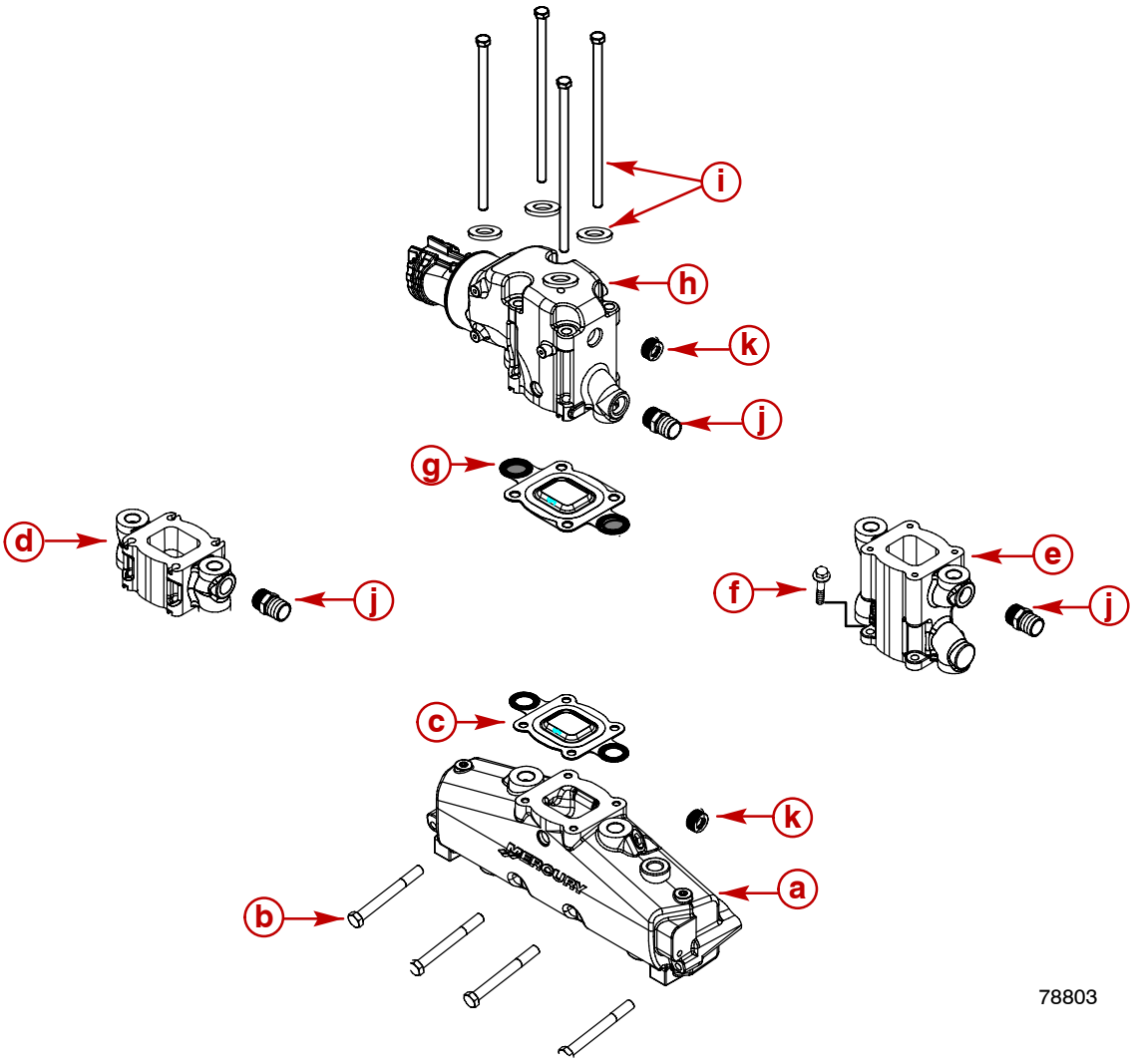
Seawater Cooled Models

IMPORTANT: On seawater cooled models, always position the restrictor gasket with the restricted port on the same side of the exhaust manifold as the exhaust elbow or riser hose fitting.



a - Exhaust manifold
b - Manifold-to-cylinder head bolt (4)
c - Full flow gasket, with turbulator
d - 76 mm (3 in.) warm riser
e - 152 mm (6 in.) warm riser
f - Riser to exhaust manifold bolt (4)
g - Restrictor gasket, with turbulator (seawater cooled models)
h - Exhaust elbow
i - Exhaust elbow to riser or exhaust manifold bolt and washer (4 each)
j - Hose fitting
k - Pipe plug

Closed Cooled Models



a - Exhaust manifold
b - Manifold-to-cylinder head bolt(4)
c - Full flow gasket, with turbulator
d - 76 mm (3 in.) warm riser
e - 152 mm (6 in.) warm riser
f - Riser to exhaust manifold bolt (4)
g - Block off gasket, with turbulator (closed cooled models)
h - Exhaust elbow
i - Exhaust elbow to riser or exhaust manifold bolt and washer (4 each)
j - Hose fitting
k - Pipe plug

Removal

⚠ WARNING

Avoid injury or death and power package damage from an electrical shock, fire or explosion. Always disconnect both battery cables from the battery before servicing the power package.

1. Disconnect both battery cables from the battery.

⚠ CAUTION

Avoid severe engine damage. Exhaust elbows and manifolds MUST BE drained to prevent coolant / water from entering combustion chambers when exhaust elbows are removed.

1. **Seawater cooled models:** Drain the seawater section of the engine.
1. **Closed cooled models:** Drain the coolant section of the engine. Refer to Section 6C.
2. Disconnect the engine exhaust hoses. Retain fasteners.
3. Disconnect all hoses from the exhaust manifold, riser, and exhaust elbow. Retain fasteners.
4. Remove and retain any items or components that are mounted to the exhaust manifold, riser, and the exhaust elbow of the engine.
5. Remove the exhaust elbow and riser. Retain fasteners.
6. Remove the exhaust manifold. Retain fasteners.
7. Discard used gaskets.

Cleaning And Inspection

1. Clean the gasket material from all surfaces and wash the parts in solvent.
2. Inspect the water passages for foreign material. The passages must be clean for efficient cooling.

NOTE: *If more thorough inspection is desired, the pipe plugs may be removed from the exhaust manifold and the exhaust elbow.*

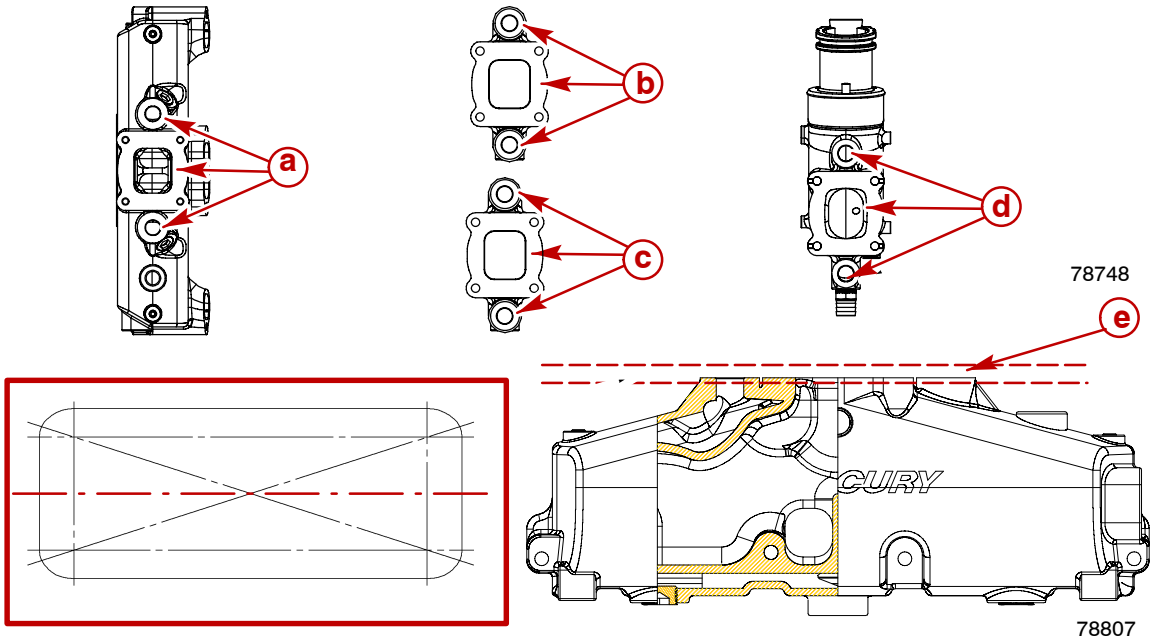
IMPORTANT: If the pipe plugs are removed, coat the threads with sealant before reinstalling.

Description	Where Used	Part Number
Loctite 567 Pipe Sealant	Pipe plug	92-804874

3. Inspect the manifold, elbow, and riser for cracks.
4. Inspect all parts carefully. Machined surfaces must be clean and free of all marks and deep scratches or water and exhaust leaks may result.
5. Inspect for damaged metal caused by saltwater or exhaust gas corrosion in the manifold, elbow, and riser.

IMPORTANT: If bare metal is present on the gasket sealing surface, Perfect Seal should be applied to that area before assembly.

6. Use a straightedge and feeler gauge to measure the profile flatness of all gasket surfaces on the manifold, elbow, and riser.
7. Ensure that the straightedge is contacting all 3 surfaces simultaneously.



a - Exhaust manifold gasket sealing surface
b - Riser gasket sealing surface on top side
c - Riser gasket sealing surface on bottom side
d - Exhaust elbow gasket sealing surface
e - Tolerance zone

NOTE: *Only use this specification if the gasket surfaces on used exhaust components have to be machined to remove minor corrosion.*

Description		mm (in.)
Surface profile	Tolerance zone	0.07 (0.003)

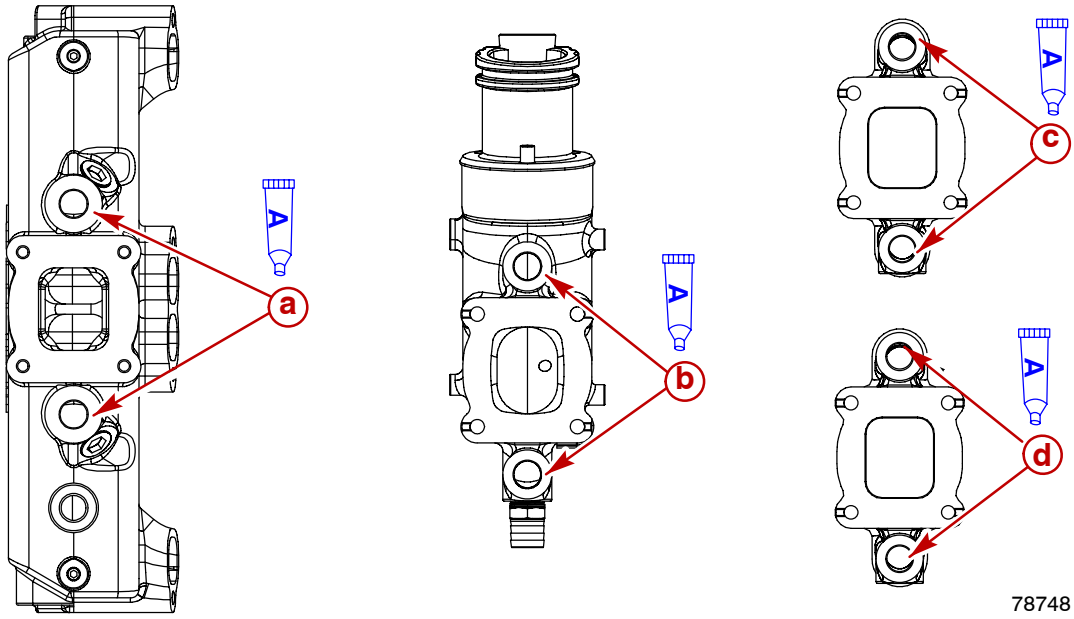
NOTE: *The maximum material that can be removed is 0.25 mm (0.010 in.). When torquing the attaching bolts, ensure that they are not contacting the bottom of the threaded hole in the manifold.*

8. If any components do not meet specifications replace the damaged components.

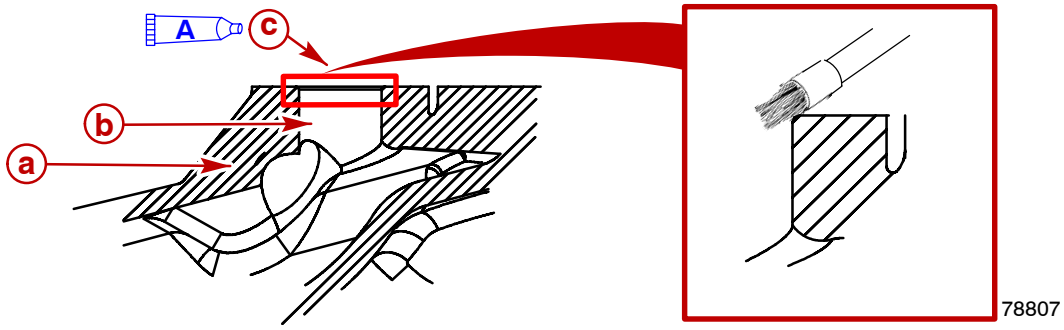
Reassembly

IMPORTANT: The edge of the water ports on all cast iron parts must be coated with Perfect Seal during assembly.

1. If exhaust elbow assembly is disassembled or risers are added, apply sealant to edge of all water ports (exhaust manifold, both sides of the riser, and exhaust elbow).



a - Exhaust manifold water port sealing surface
b - Exhaust elbow water port sealing surface
c - Riser water port sealing surface on top side
d - Riser water port sealing surface on bottom side



a - Exhaust manifold (cross section)
b - Exhaust manifold water port
c - Edge of water port (area to apply sealant)

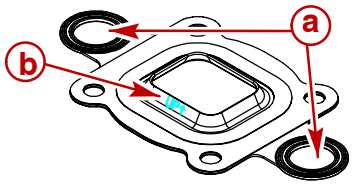
Description		Where Used	Part Number
A	Perfect Seal	Edge of water ports	92-34227-1

Gasket Application

Full Flow Gasket

IMPORTANT: Full flow gasket is not used on engines without risers.

IMPORTANT: On warm riser models, the full flow gasket must be placed between exhaust manifolds and riser.



78804

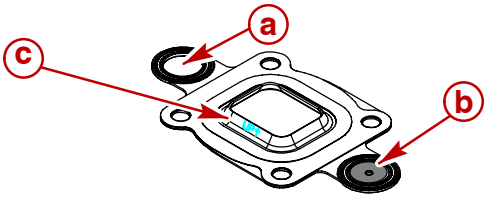
a - Passages fully open
b - Turbulator oriented up

Restrictor Flow Gasket

IMPORTANT: Restrictor gasket must be used on all SEAWATER COOLED engines.

IMPORTANT: On warm riser models, the restrictor gasket must be placed between the riser and the exhaust elbow.

IMPORTANT: The restrictor end of the gasket must be positioned to the seawater inlet side of the exhaust elbow.



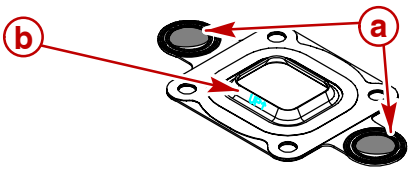
78805

a - Full flow passage
b - Restricted flow passage
c - Turbulator oriented up

Block-Off Gasket

IMPORTANT: Block-off gasket must be used on all CLOSED COOLED engines.

IMPORTANT: On warm riser models, the block-off gasket must be placed between the riser and the exhaust elbow.



78806

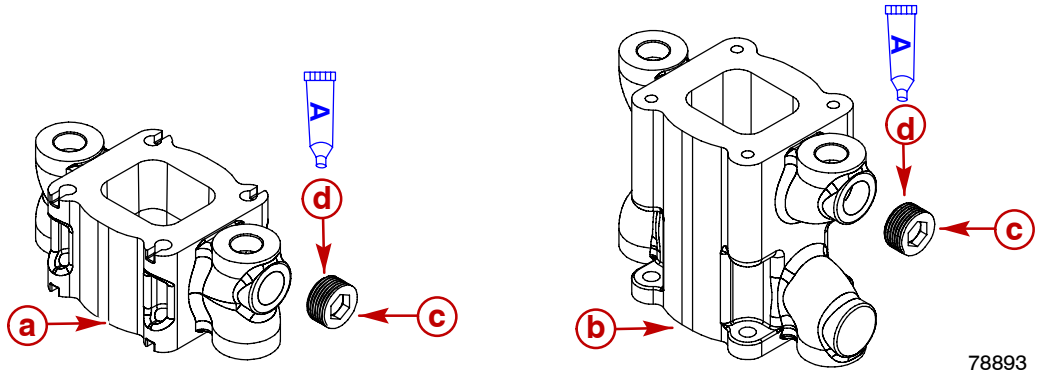
a - No opening for water flow
b - Turbulator oriented up

Installation

⚠ CAUTION

Avoid severe engine damage. The turbulator gasket MUST BE properly installed to avoid overheating due to insufficient water flow or coolant loss through exhaust.

1. **On seawater cooled models:** Apply sealant to threads of the pipe plug and install into the riser.



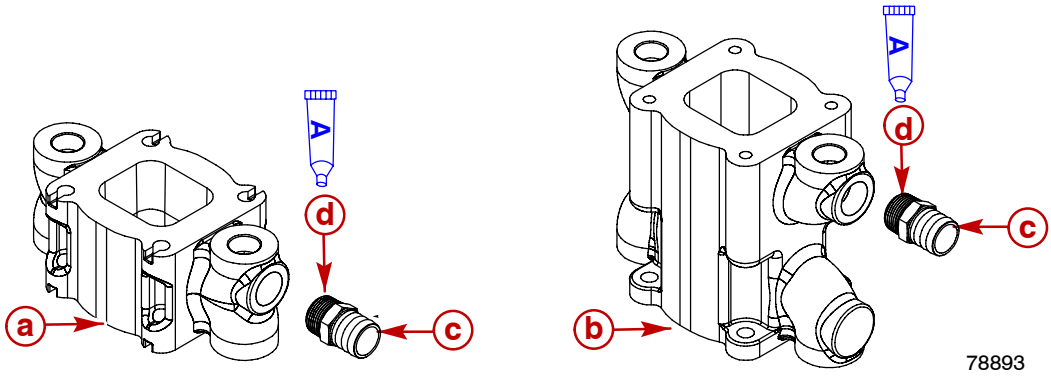
a - 76 mm (3 in.) riser
b - 152 mm (6 in.) riser
c - Pipe plug
d - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Pipe plug	92-804874

2. Torque pipe plug.

Description	Nm	lb-in.	lb-ft
Pipe plug to riser	50		37

3. **On closed cooled models:** Apply sealant to threads of the hose fittings and install into the risers.



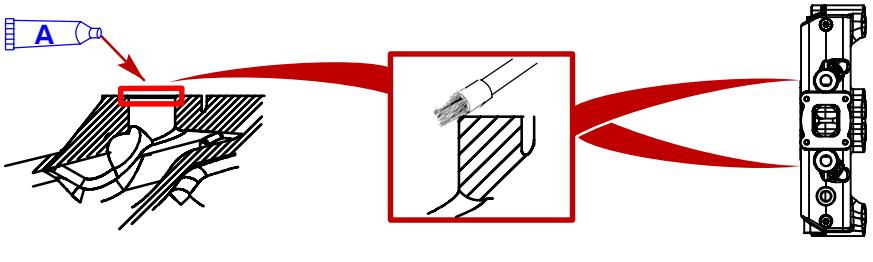
a - 76 mm (3 in.) riser
b - 152 mm (6 in.) riser
c - Hose fitting
d - Sealant applied to threads

Description		Where Used	Part Number
A	Loctite 567 Pipe Sealant	Hose fitting	92-804874

4. Torque hose fitting.

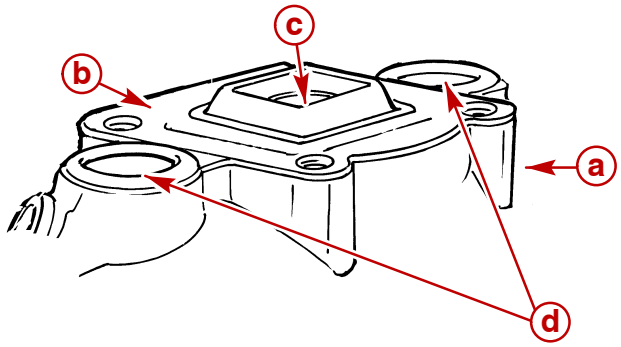
Description	Nm	lb-in.	lb-ft
Hose fitting to riser	50		37

5. Apply sealant to the edge of each of the 2 water ports located on the exhaust manifold.



Description		Where Used	Part Number
A	Perfect Seal	Edge of water ports	92-34227-1

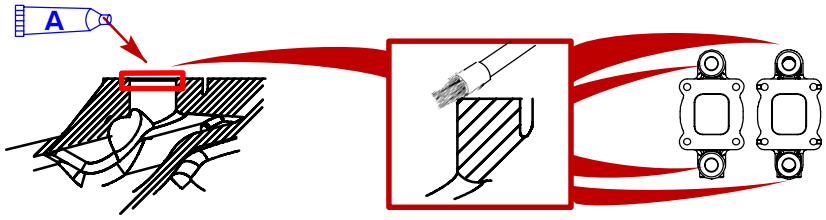
6. Place the full flow gasket on the exhaust manifold with the side marked “UP” visible.



78485

a - Exhaust manifold
b - Full flow gasket
c - Turbulator oriented up
d - Passages fully open

7. Apply sealant to the edge of each of the 4 water ports located on the riser.

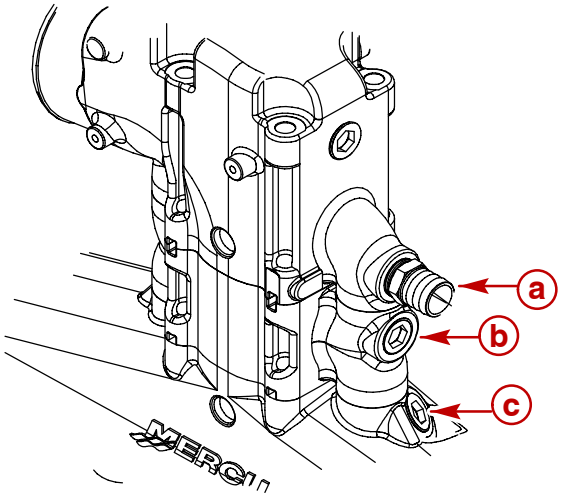


78807

Description		Where Used	Part Number
A	Perfect Seal	Edge of water ports	92-34227-1

8. Place the riser on the exhaust manifold as shown.

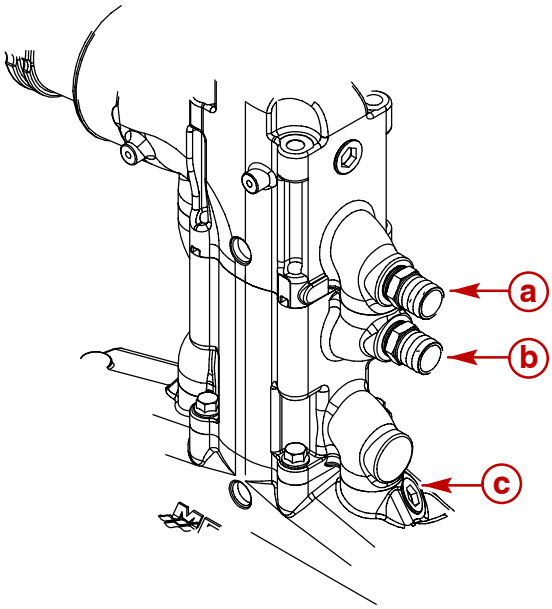
NOTE: *Position of the riser outlet water port is closest to exhaust elbow.*



78893

Seawater cooled models (76 mm [3 in.] riser shown, 152 mm [6 inch] riser similar)

a - Exhaust elbow inlet water port with hose fitting
b - Riser outlet water port with pipe plug (seawater cooled)
c - Exhaust manifold outlet water port with pipe plug



78893

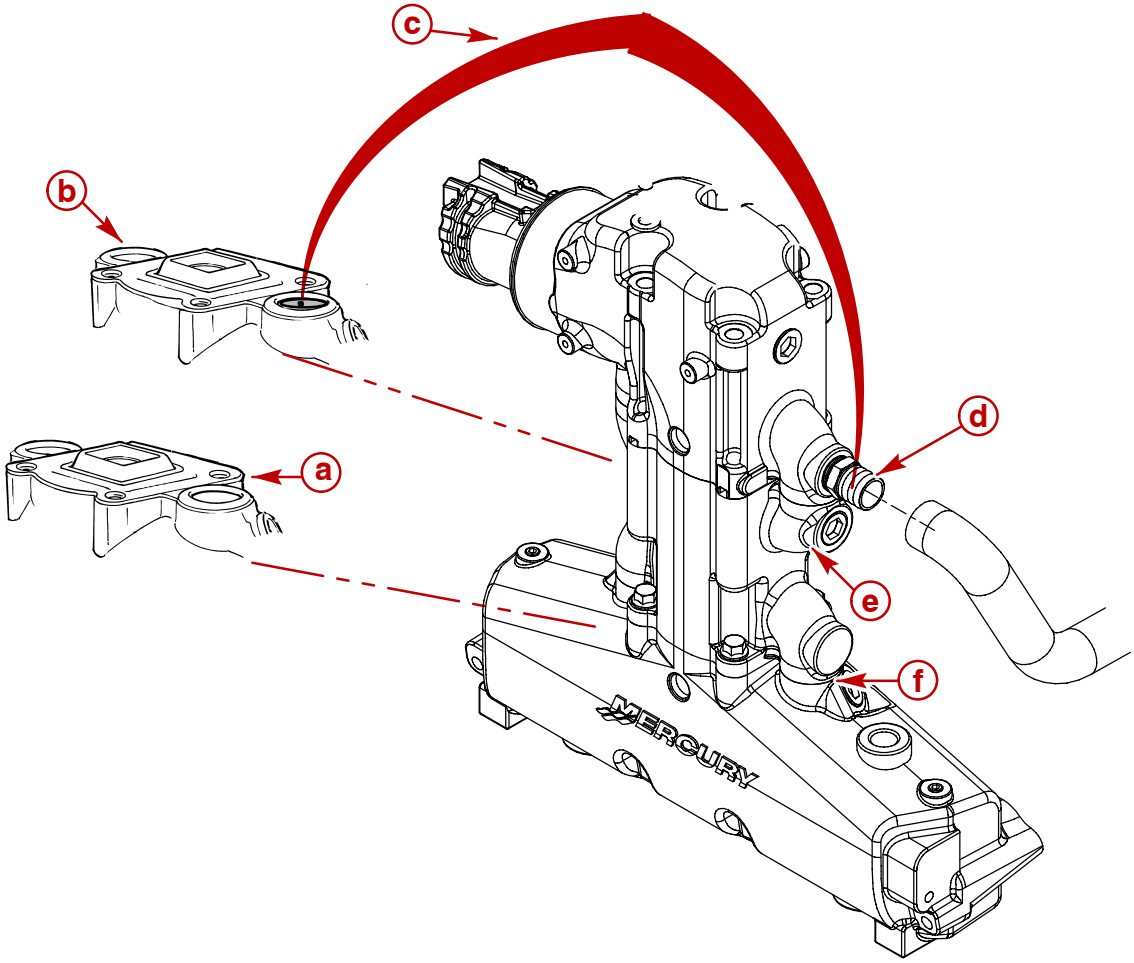
Closed cooled models (152 mm [6 in.] riser shown, 76 mm [3 in.] riser similar)

a - Exhaust elbow inlet water port with hose fitting
b - Riser outlet water port with hose fitting (closed cooled)
c - Exhaust manifold outlet water port with pipe plug

NOTE: Closed cooled models: *Ensure that the hose fitting, located in the riser outlet water port, is positioned to accept the engine coolant hose.*

9. **On 152 mm (6 inch) riser:** Install and hand-tighten screws to temporarily secure the riser and gasket to the exhaust manifold.

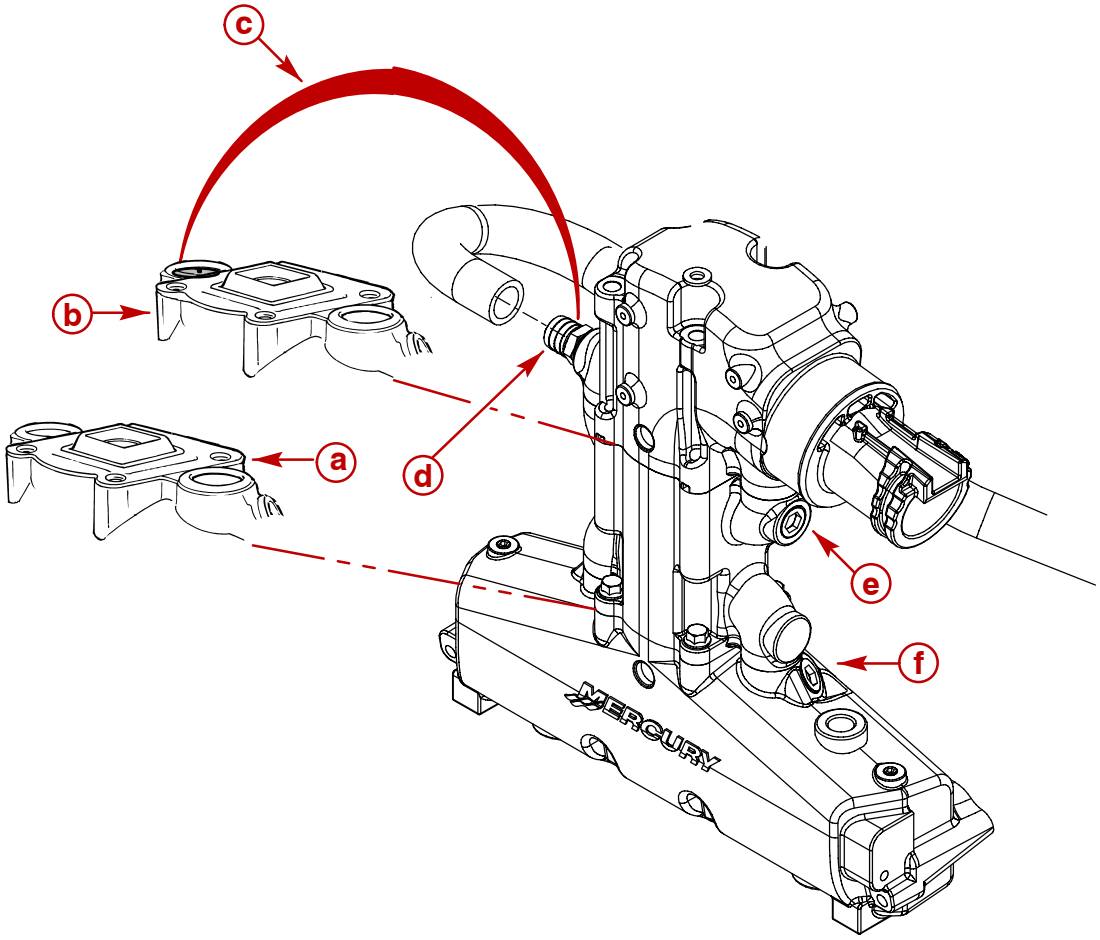
10. **On seawater cooled models only:** Place the restrictor gasket on the riser with the side marked “UP” visible. Ensure that the restricted water port of the restrictor gasket is on the same side as the hose fitting of the exhaust elbow.



78911

MCM and MIE inline exhaust seawater cooled models

- **a** - Full flow gasket positioned between exhaust manifold and riser
- **b** - Restrictor gasket positioned between riser and exhaust elbow
- **c** - Restricted water port of gasket is in line with hose fitting of exhaust elbow
- **d** - Exhaust elbow inlet water port with hose fitting
- **e** - Riser outlet water port with pipe plug
- **f** - Exhaust manifold outlet water port with pipe plug

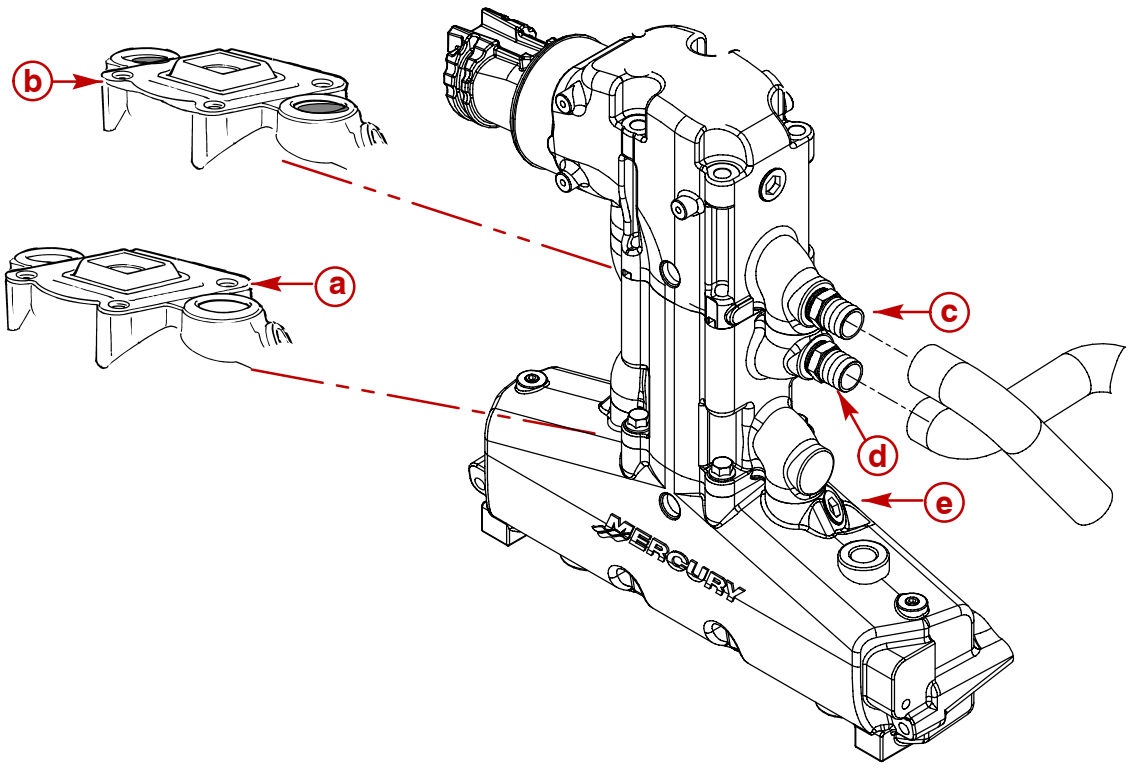


78912

MIE V-drive seawater cooled models

- **a** - Full flow gasket positioned between exhaust manifold and riser
- **b** - Restrictor gasket positioned between riser and exhaust elbow
- **c** - Restricted water port of gasket is in line with hose fitting of exhaust elbow
- **d** - Exhaust elbow inlet water port with hose fitting
- **e** - Riser outlet water port with pipe plug
- **f** - Exhaust manifold outlet water port with pipe plug

11. **On closed cooled models:** Place the block-off gasket on the riser with the side marked "UP" visible.

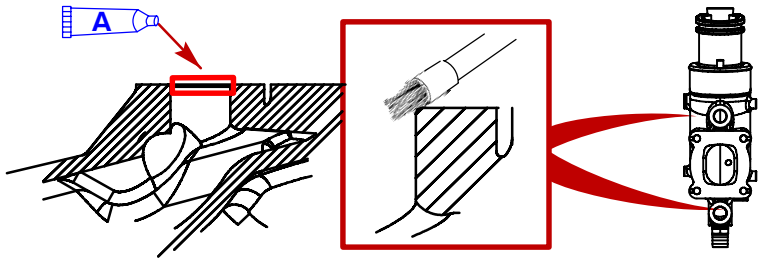


78882

MCM and MIE inline exhaust closed cooled models

- **a** - Full flow gasket positioned between exhaust manifold and riser
- **b** - Block off gasket positioned between riser and exhaust elbow
- **c** - Exhaust elbow inlet water port with hose fitting
- **d** - Riser outlet water port with hose fitting
- **e** - Exhaust manifold outlet water port with pipe plug

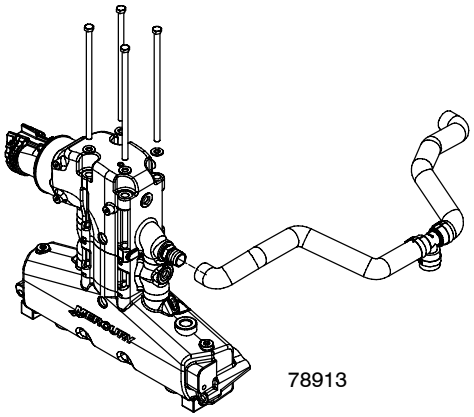
12. Apply sealant to the edge of each of the 2 water ports located on the exhaust elbow.



78807

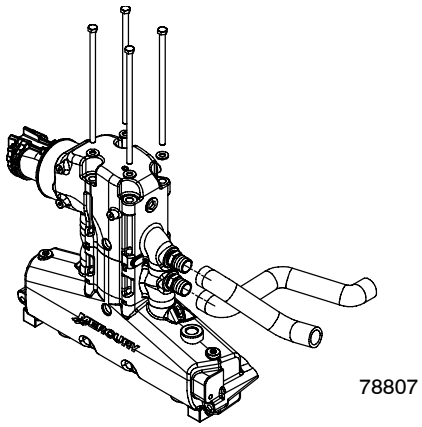
Description		Where Used	Part Number
A	Perfect Seal	Edge of water ports	92-34227-1

13. Place the exhaust elbow on the riser as shown.



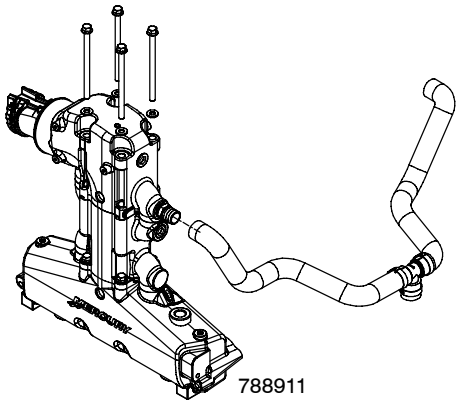
78913

Seawater cooled 76 mm (3in.) riser



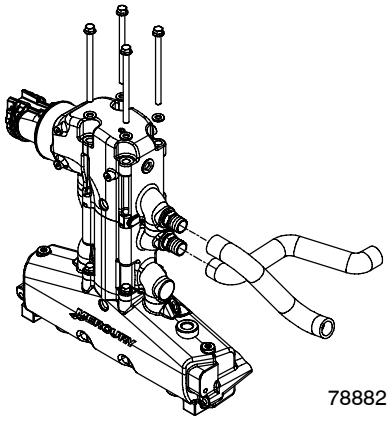
78807

Closed cooled 76 mm (3 in.) riser



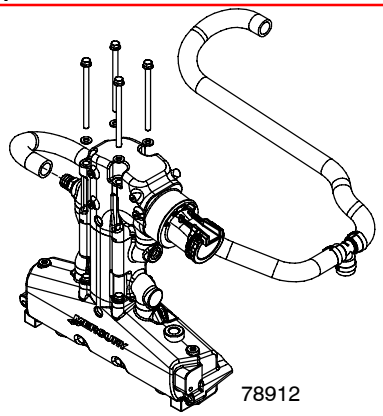
788911

Seawater cooled 152 mm (6 in.) riser

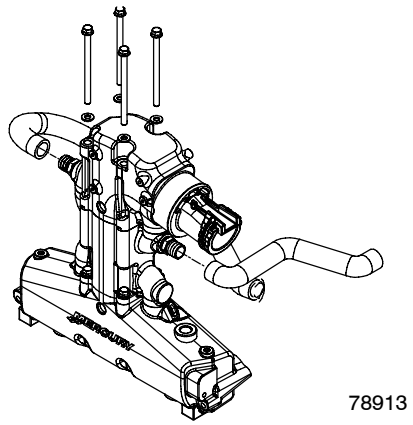


78882

Closed cooled 152 mm (6 in.) riser



Seawater cooled V-drive 152 mm (6 in.) riser



Closed cooled V-drive 152 mm (6 in.) riser

IMPORTANT: The 7-1/2 in. (190.5 mm), 9 in. (228.6 mm) long and 10-1/2 in. (266.7mm) exhaust elbow screws require that a specific flat washer be used in conjunction with the screw. Refer to "*Mercury Precision Parts/Quicksilver Accessories Guide.*"

14. If applicable, assemble washers to the exhaust elbow screws.
15. Apply sealant to exhaust elbow screw threads and hand-start to temporarily secure the assembly.

Description	Where Used	Part Number
Perfect Seal	Edge of water ports	92-34227-1

16. Align the exhaust elbow to the engine exhaust system.
17. **On 152 mm (6 in.) riser model:** Tighten and torque the screws holding the riser to the exhaust manifold.

NOTE: *Gasket is not reusable. Inspect for proper gasket and component position before torquing.*

Description		Nm	lb-in.	lb-ft
Exhaust elbow and riser to exhaust manifold screws				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45

18. If applicable, ensure that washers are in place between bolt and exhaust elbow.
19. Torque the exhaust elbow fasteners.

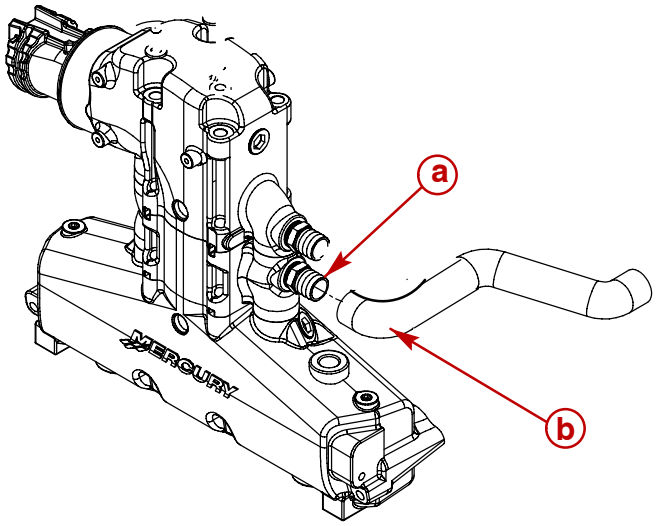
Description		Nm	lb-in.	lb-ft
Exhaust elbow and riser to exhaust manifold screws				
Tighten screws evenly using X pattern from corner to corner	First pass	9	84	
	Final pass	61		45

20. **On seawater cooled models:** Connect the engine water hoses to the exhaust elbows and tighten hose clamps securely.

⚠ CAUTION

Avoid severe engine damage due to improper hose connection, causing coolant to discard out exhaust. DO NOT connect the engine coolant hose to the exhaust elbow.

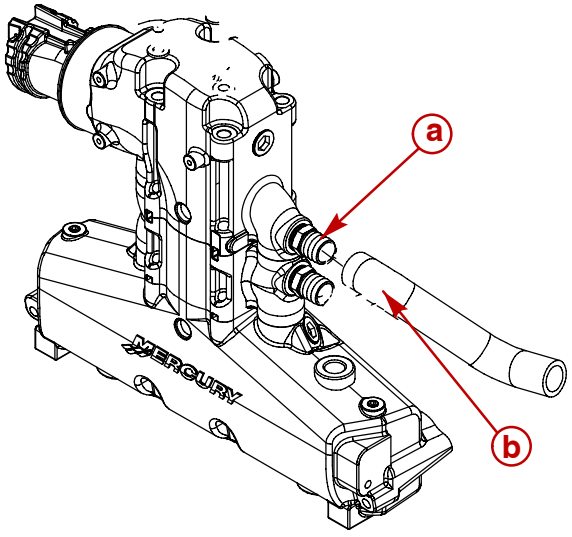
21. **On closed cooling models:** Connect the coolant hose from the thermostat housing to the hose fitting of the riser. Tighten hose clamps securely.



78758

a - Riser fitting
b - Engine coolant hose

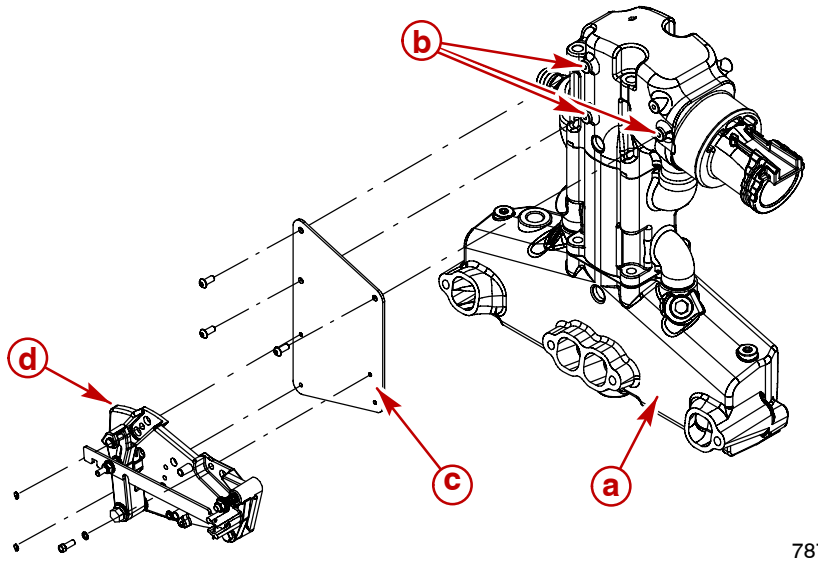
22. **On closed cooled models:** Connect the engine water hose from the heat exchanger to the exhaust elbow and tighten hose clamps securely.



78759

a - Exhaust elbow fitting
b - Engine water hose

23. **Starboard exhaust elbow:** MCM only.
    a. On 152 mm (6 in.) riser, install the drop-down shift plate bracket.
    b. Install the shift plate assembly to the elbow.
    c. Tighten securely.

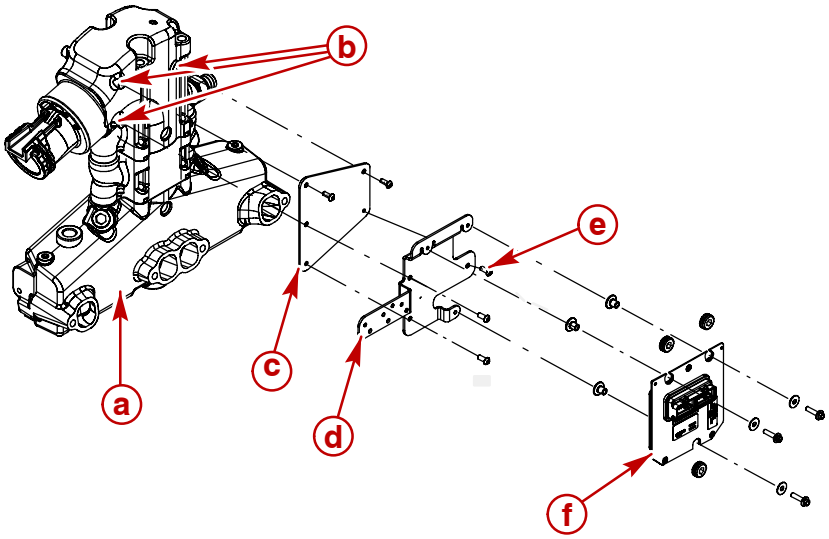


78788

Drop-down bracket for the 152 mm (6 in.) riser assembly

a - Exhaust manifold, riser, elbow and assembly
b - Bracket mounting holes
c - Drop-down bracket
d - Shift bracket

24. **Port exhaust elbow with 76 mm (3 in.) riser:** All models.
    a. Install the ECM drop-down bracket.
    b. Install the ECM bracket and the ECM to the exhaust elbow.
    c. Tighten securely.

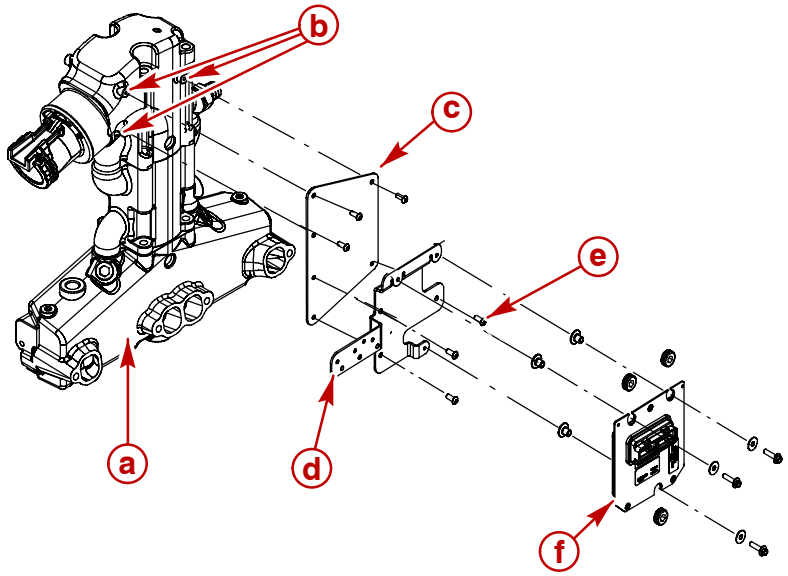


78787

Drop-down bracket for the 76 mm (3 in.) riser assembly

- **a** - Exhaust manifold, riser, and elbow assembly
- **b** - Bracket mounting holes
- **c** - Drop-down bracket
- **d** - ECM bracket
- **e** - Short screw
- **f** - ECM

25. **Port exhaust elbow with 152 mm (6 in.) riser:** All models.
    a. Install the ECM drop-down bracket.
    b. Install the ECM bracket and the ECM to the exhaust elbow.
    c. Tighten securely.



78789

Drop-down bracket for the 152 mm (6 in.) riser assembly

- **a** - Exhaust manifold, riser, and elbow assembly
- **b** - Bracket mounting holes
- **c** - Drop-down bracket
- **d** - ECM bracket
- **e** - Short screw
- **f** - ECM

26. Install the exhaust hoses and the cooling hoses.
27. Tighten hose clamps securely.
28. Install any additional components removed during disassembly.
29. Reconnect the battery cables to the battery. Tighten securely.

⚠ CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

30. Supply cooling water to the engine.
31. Start the engine and check for exhaust and water leaks.

NOTES:

COLOR DIAGRAMS

Section 10 - Color Diagrams

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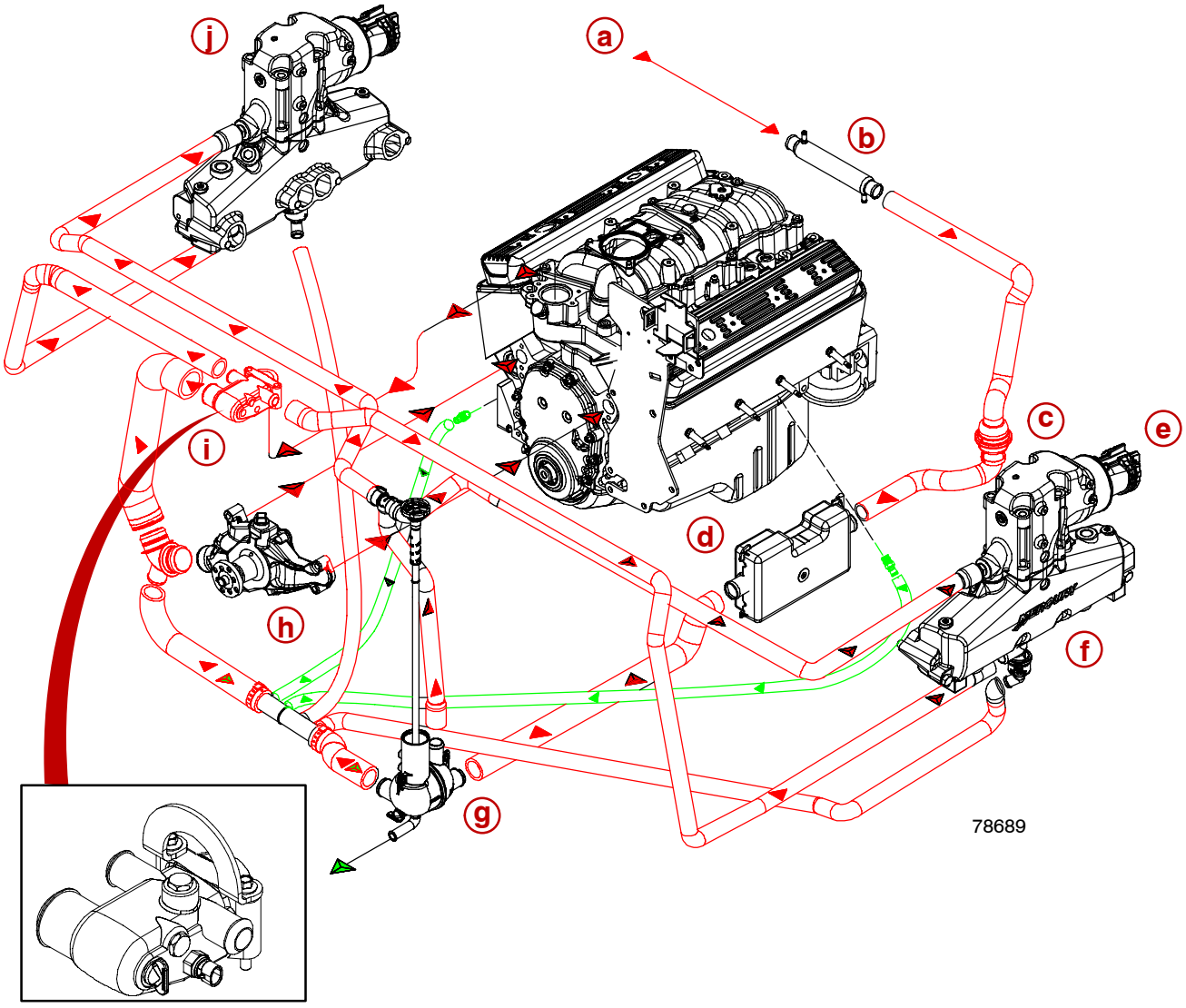
10 A

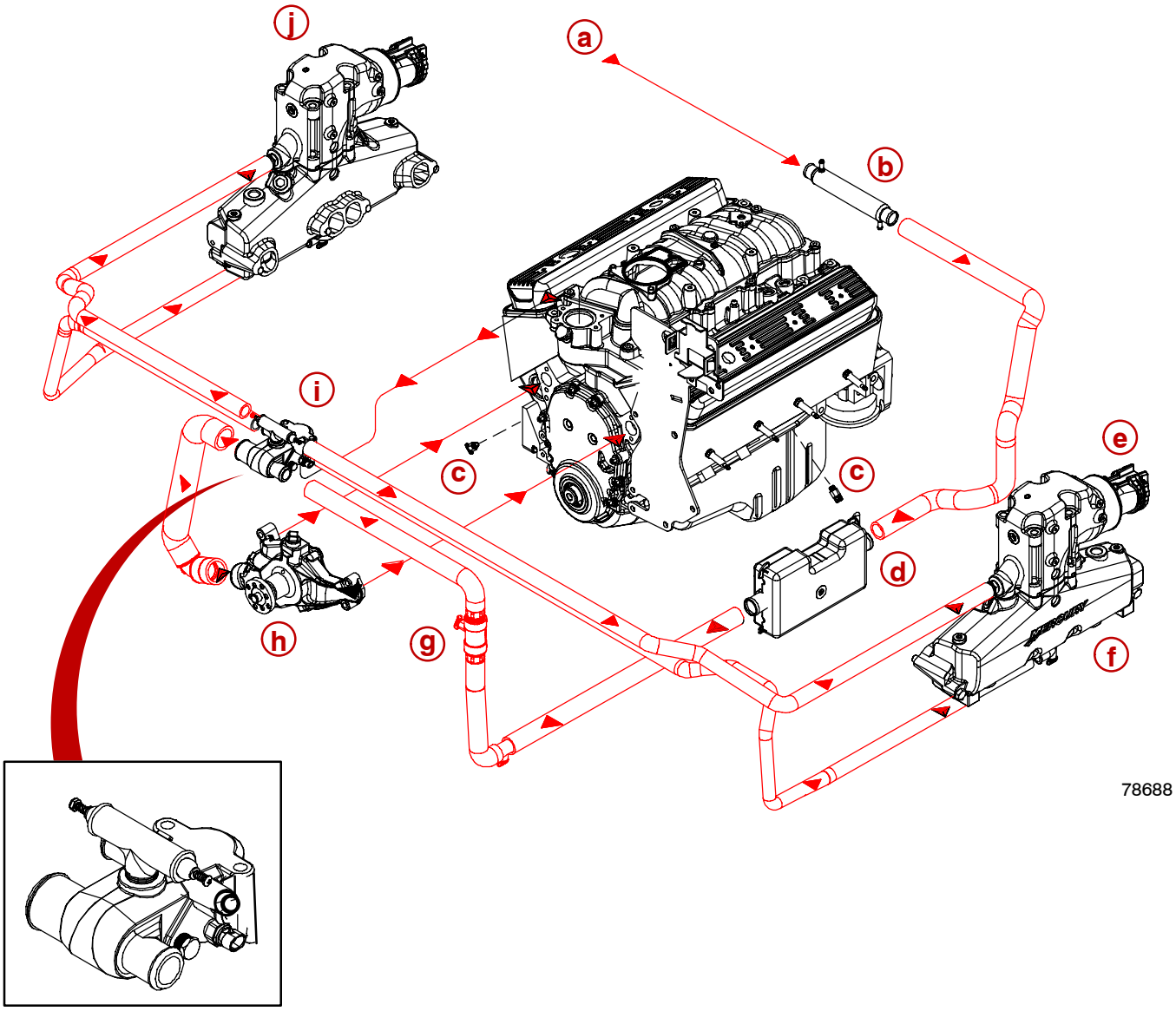
Water Flow Diagrams

Seawater Cooled Alpha Models Except MPD Models



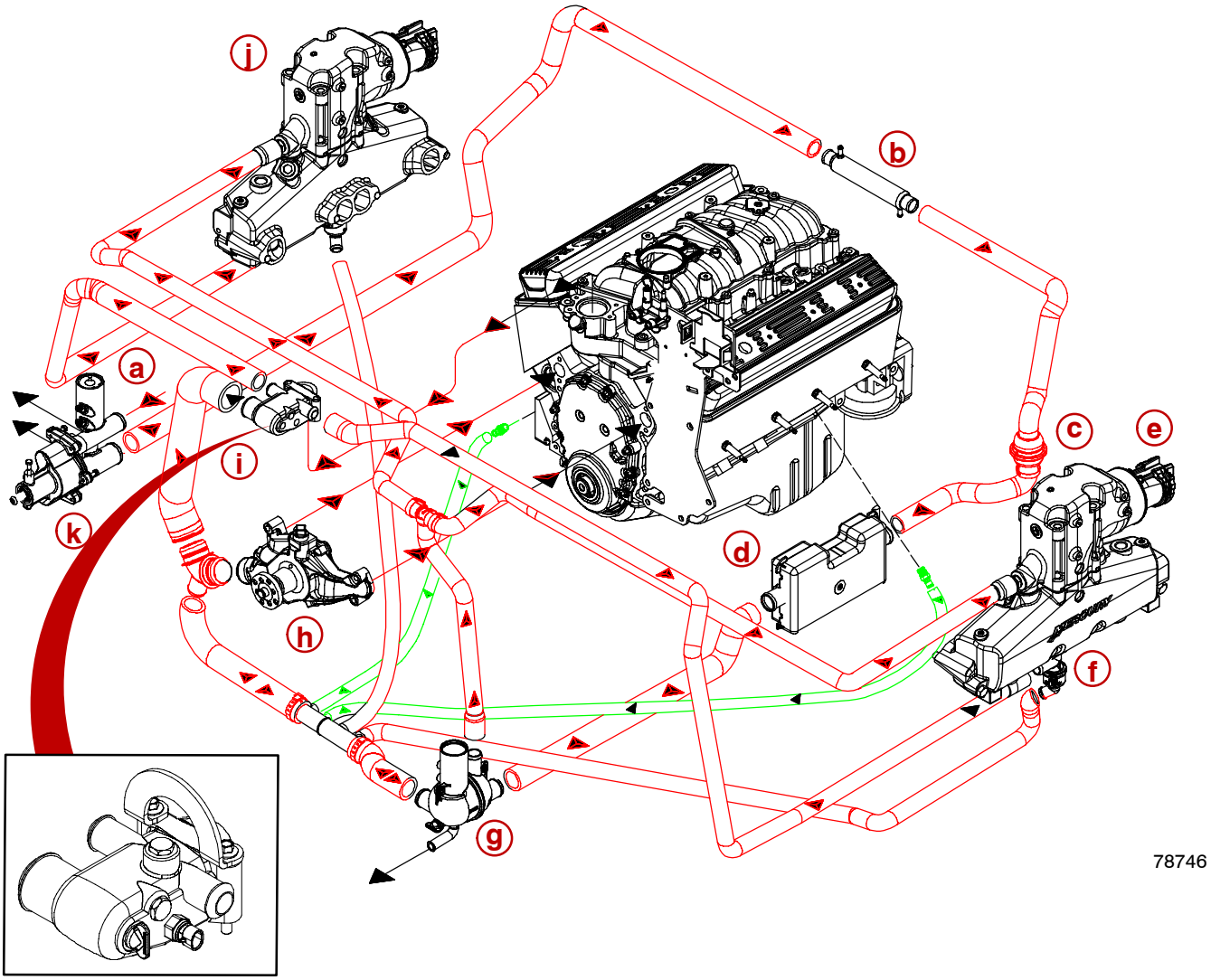
a - Seawater inlet (From transom)
b - Power steering cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing (lifting eye bracket not shown)
j - Exhaust elbow

Seawater Cooled Alpha MPD Models



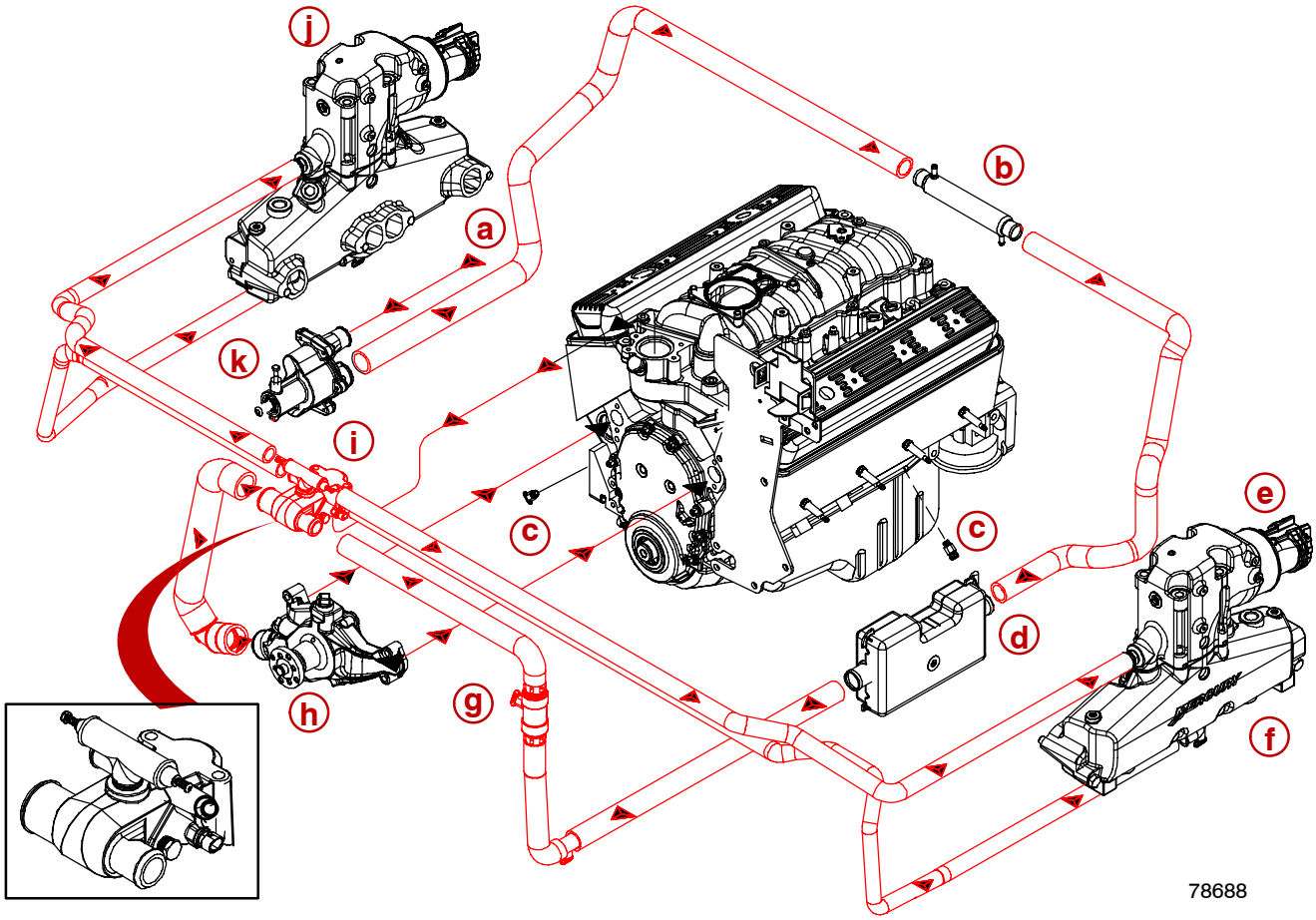
a - Seawater inlet (From transom)
b - Power steering cooler
c - Drain plug
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Check valve (MPI models only)
h - Water circulating pump
i - Thermostat housing (lifting eye bracket not shown)
j - Exhaust elbow

Seawater Cooled Bravo Models Except MPD Models



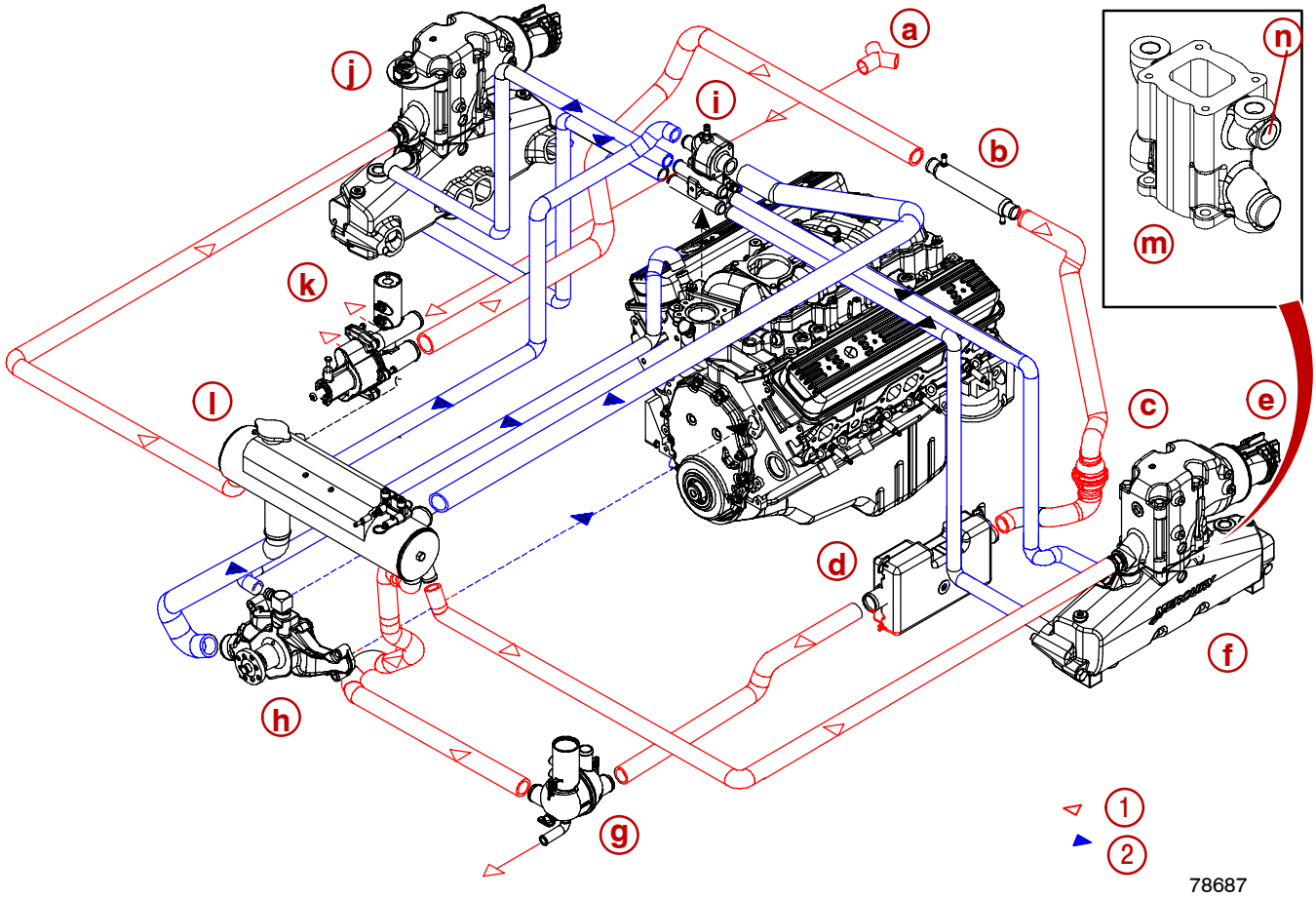
- **a** - Seawater inlet
- **b** - Power steering cooler
- **c** - Check valve
- **d** - Fuel cooler
- **e** - Exhaust and seawater outlet
- **f** - Exhaust manifold
- **g** - Distribution housing
- **h** - Water circulating pump
- **i** - Thermostat housing (lifting eye bracket not shown)
- **j** - Exhaust elbow
- **k** - Seawater pump

Seawater Cooled Bravo MPD Models



a - Seawater inlet
b - Power steering cooler
c - Drain plug
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Check valve
h - Water circulating pump
i - Thermostat housing (lifting eye bracket not shown)
j - Exhaust elbow
k - Seawater pump

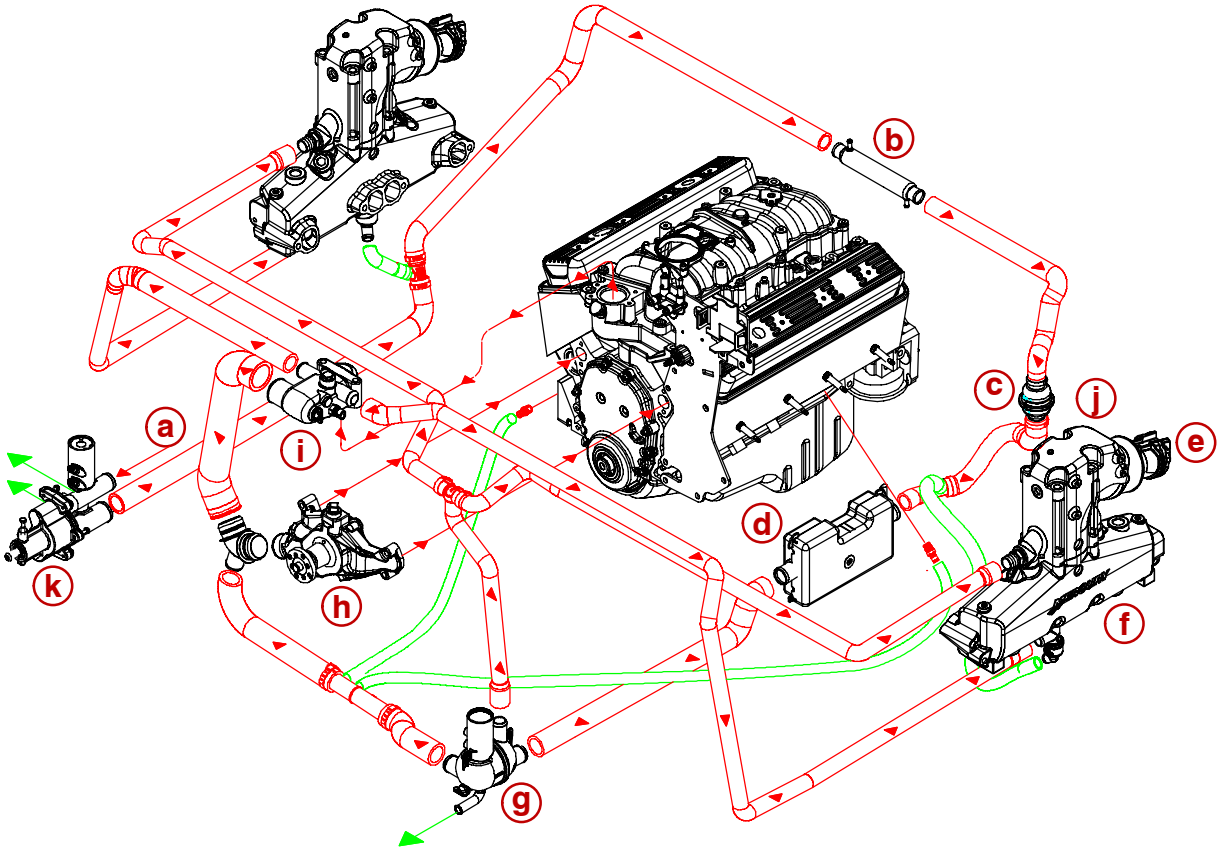
Closed Cooled Sterndrive Models



a - Y-fitting (Bravo models only)
b - Power steering cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump
l - Heat exchanger
m - Warm riser (6 in.)
n - Hose fitting port

1 - Seawater
2 - Ethylene glycol mix

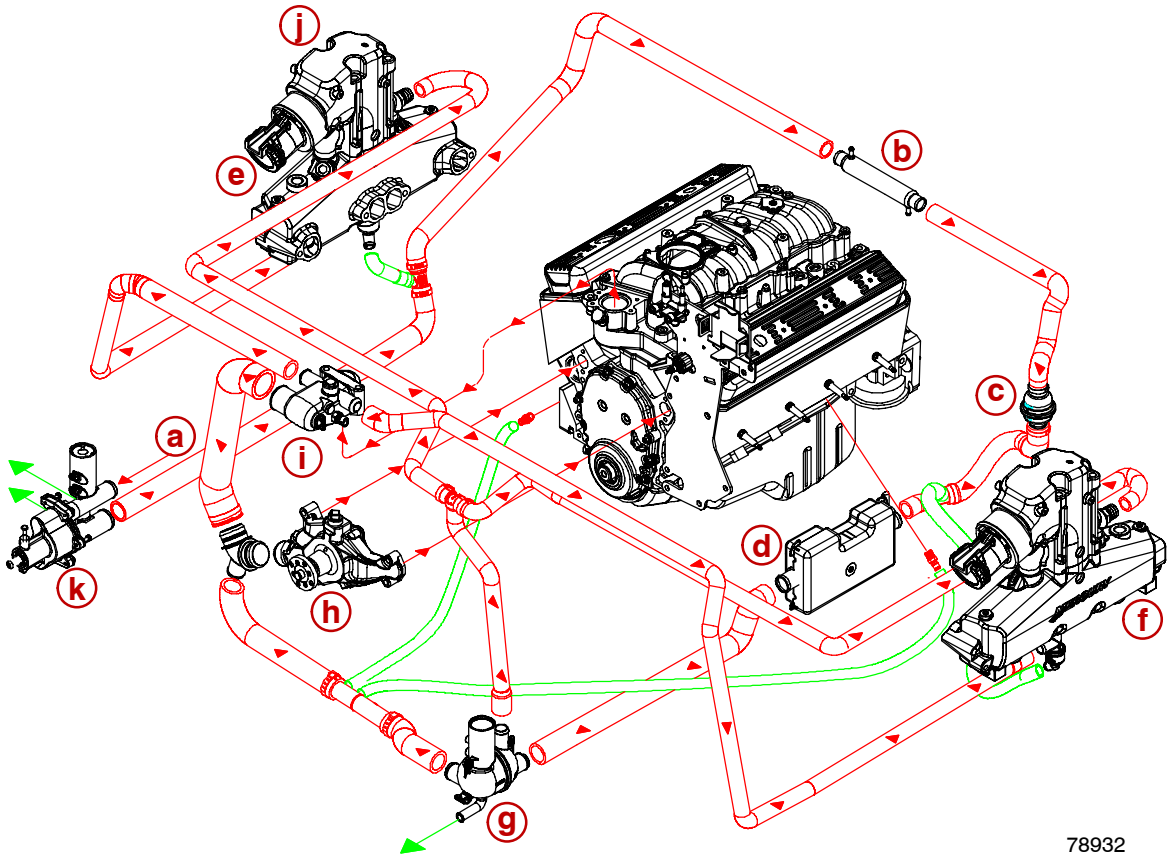
Seawater Cooled Inline Inboard Models



78933

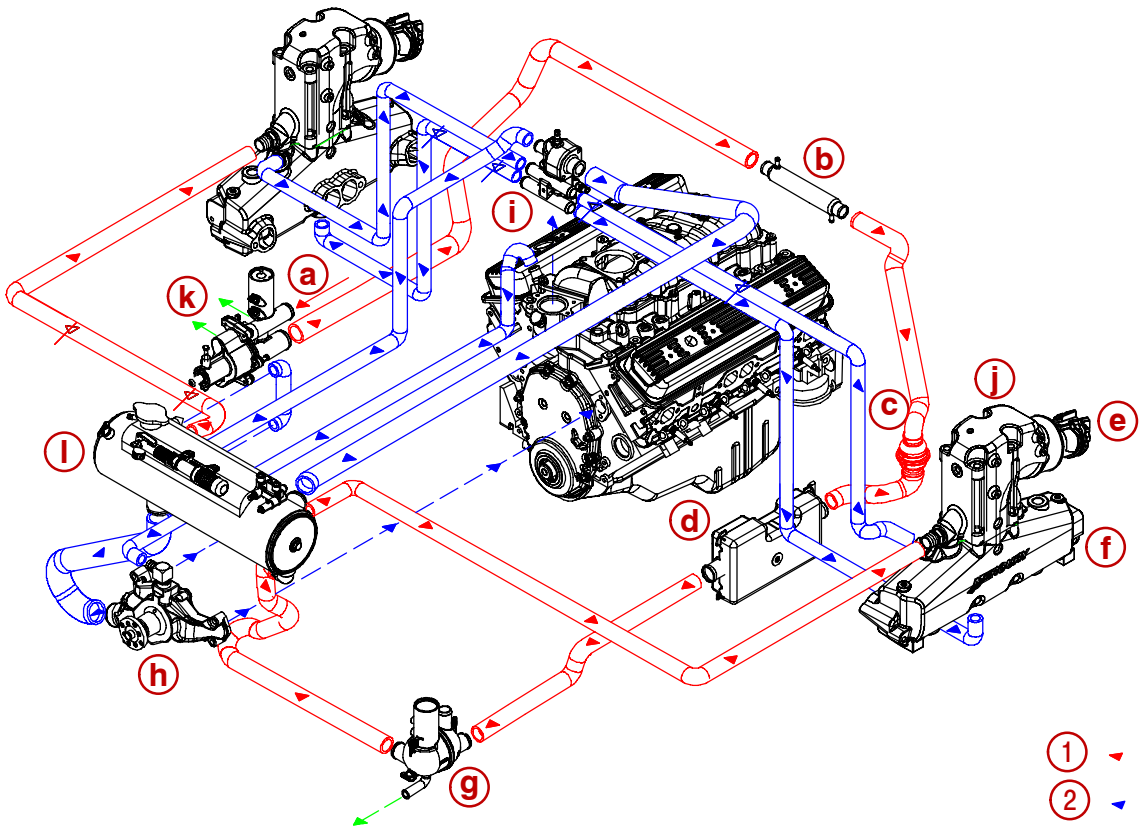
a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump

Seawater Cooled V-drive Inboard Models



a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump

Closed Cooled Inline Inboard Models

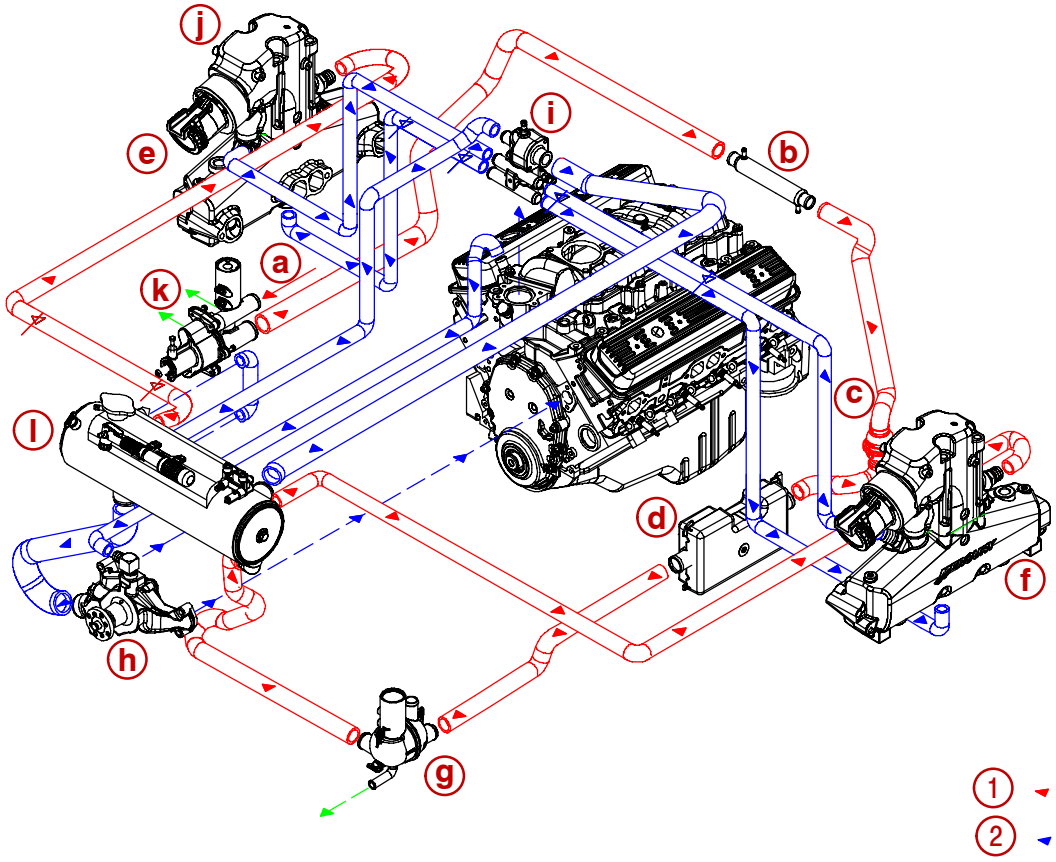


78927

a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump
l - Heat exchanger

1 - Seawater
2 - Ethylene glycol mix

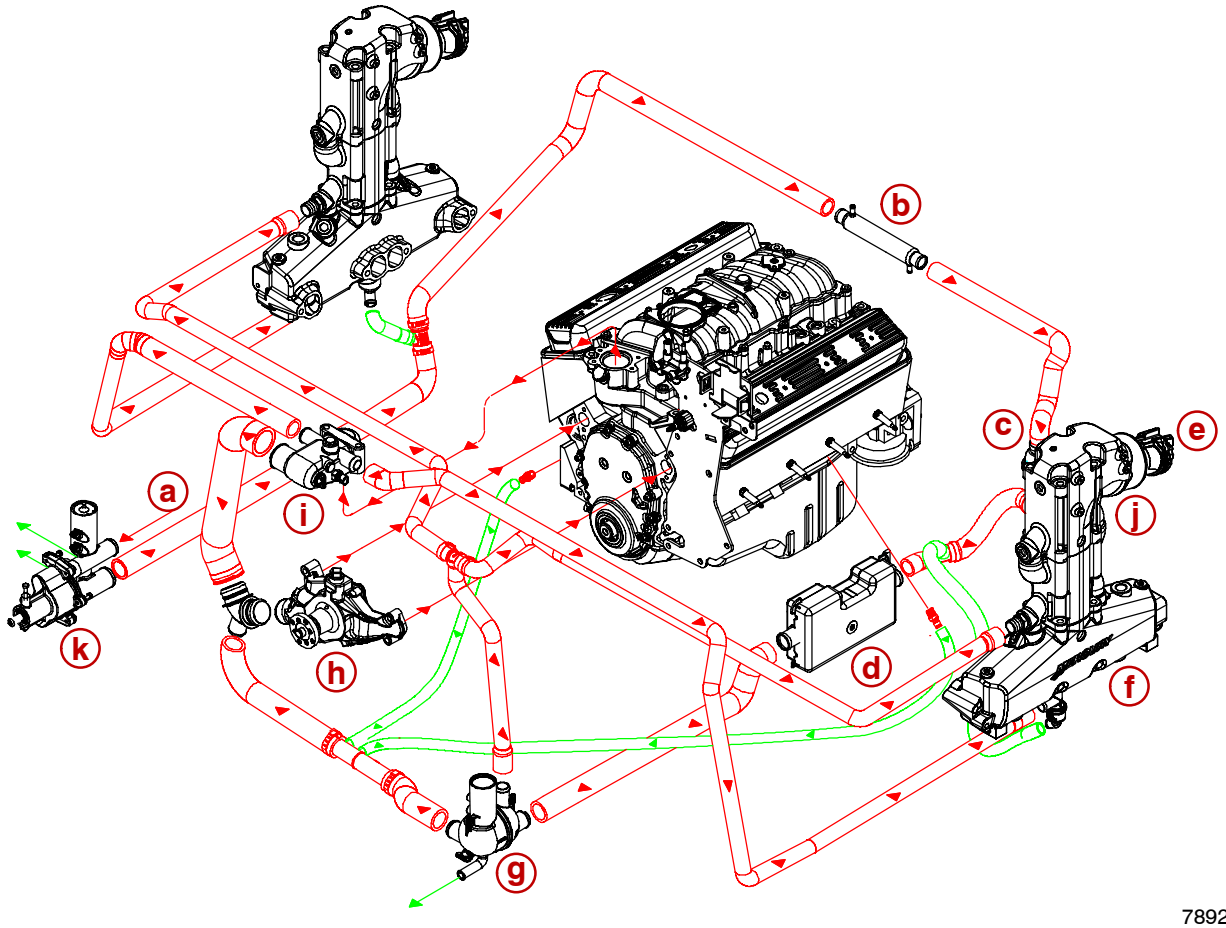
Closed Cooled V-drive Inboard Models



a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump
l - Heat exchanger

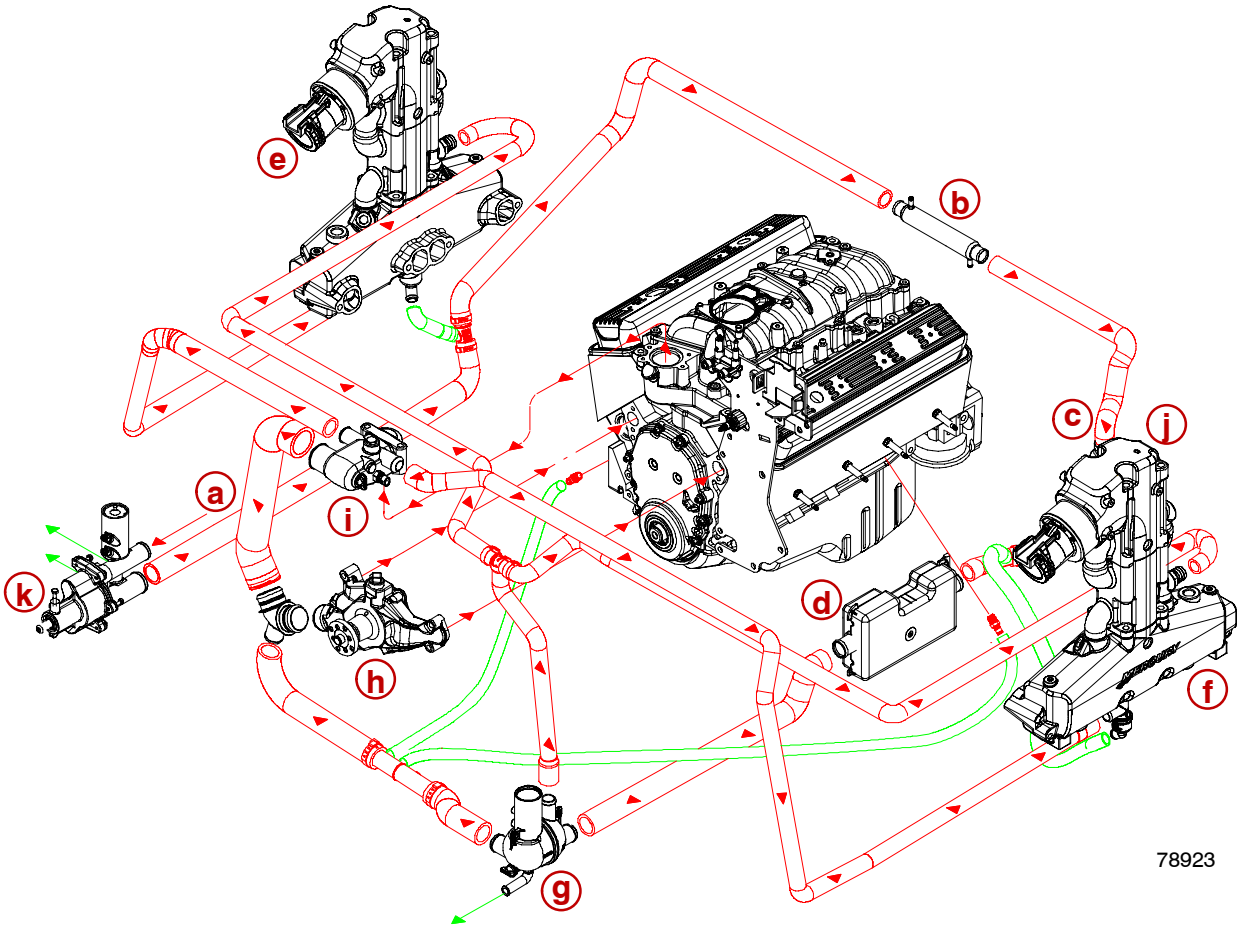
1 - Seawater
2 - Ethylene glycol mix

Seawater Cooled Bravo And Inline Inboard Models With Cold Risers



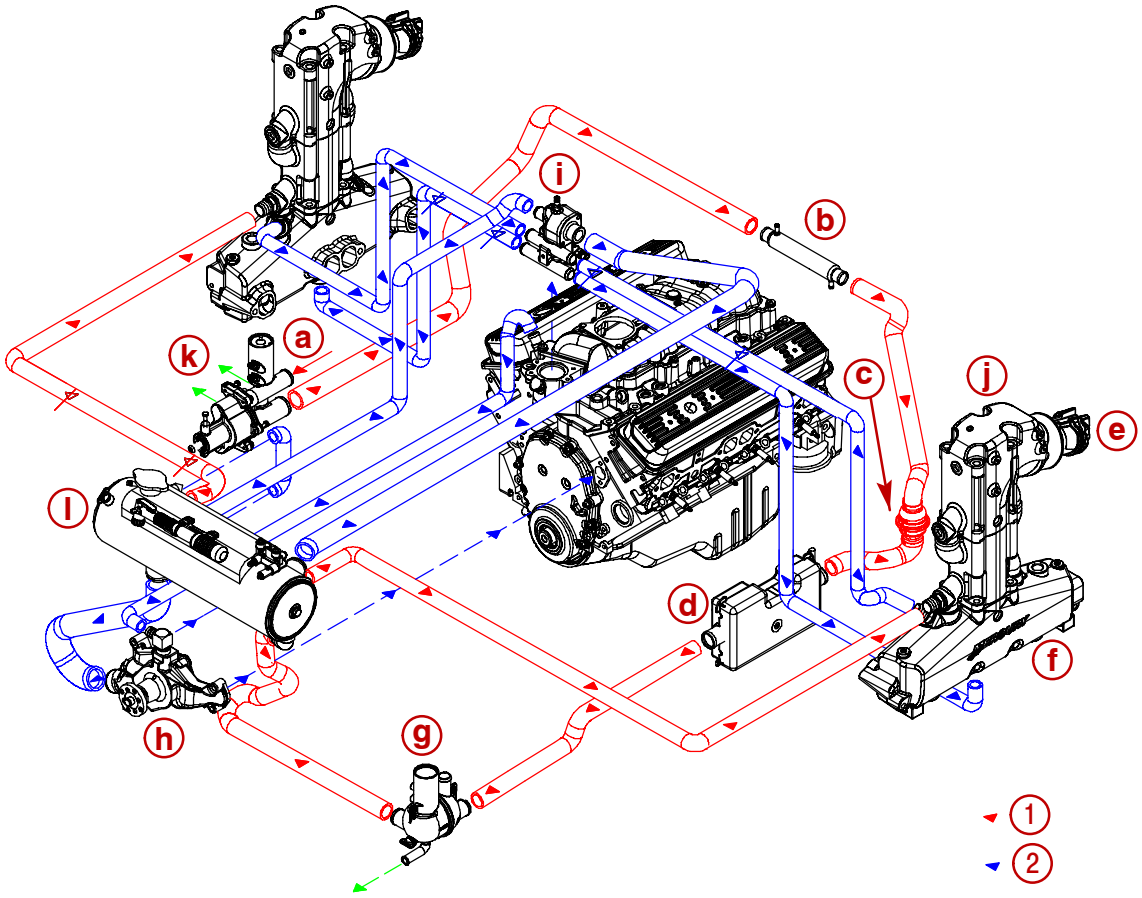
a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - 14 degree exhaust elbow shown (7 degree exhaust elbow similar)
k - Seawater pump

Seawater Cooled V-drive Models With Cold Risers



a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump

Closed Cooled Sterndrive And Inline Inboard Models With Cold Risers



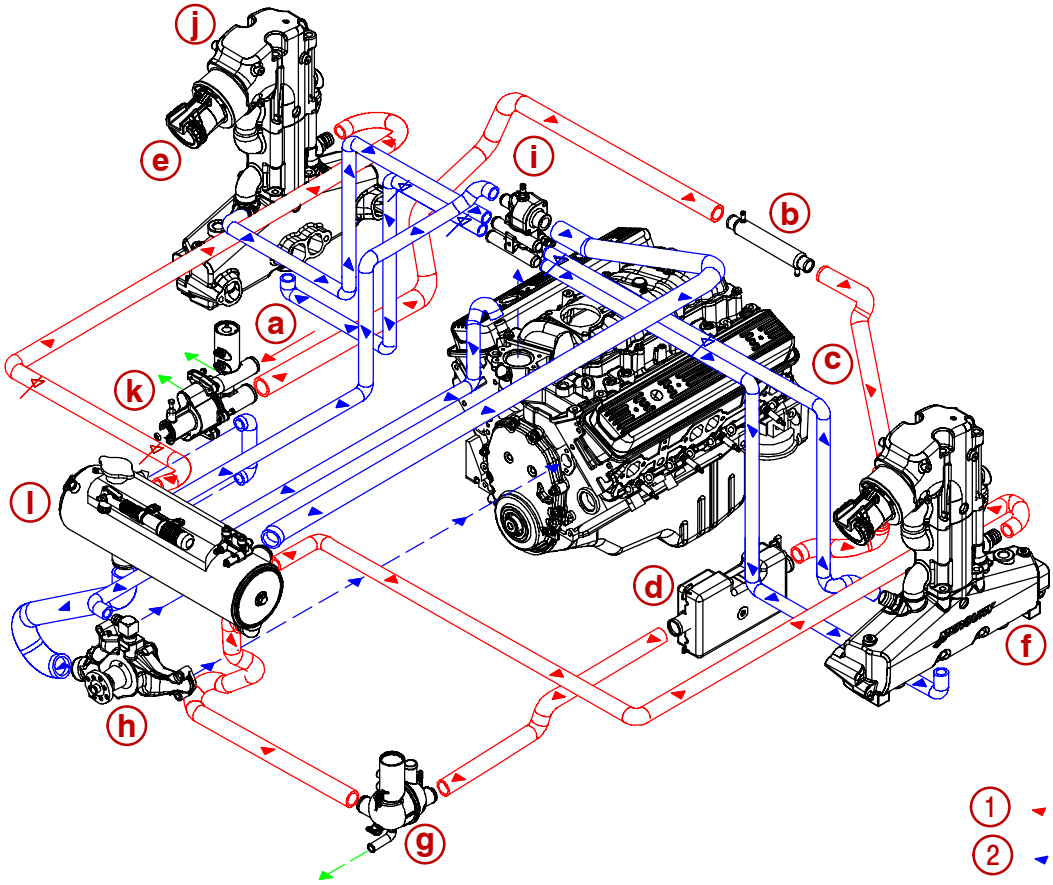
78924

a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing

1 - Seawater
2 - Ethylene glycol mix

h - Water circulating pump
i - Thermostat housing
j - 14 degree exhaust elbow shown (7 degree exhaust elbow similar)
k - Seawater pump
l - Heat exchanger

Closed Cooled V-drive Inboard Models With Cold Risers

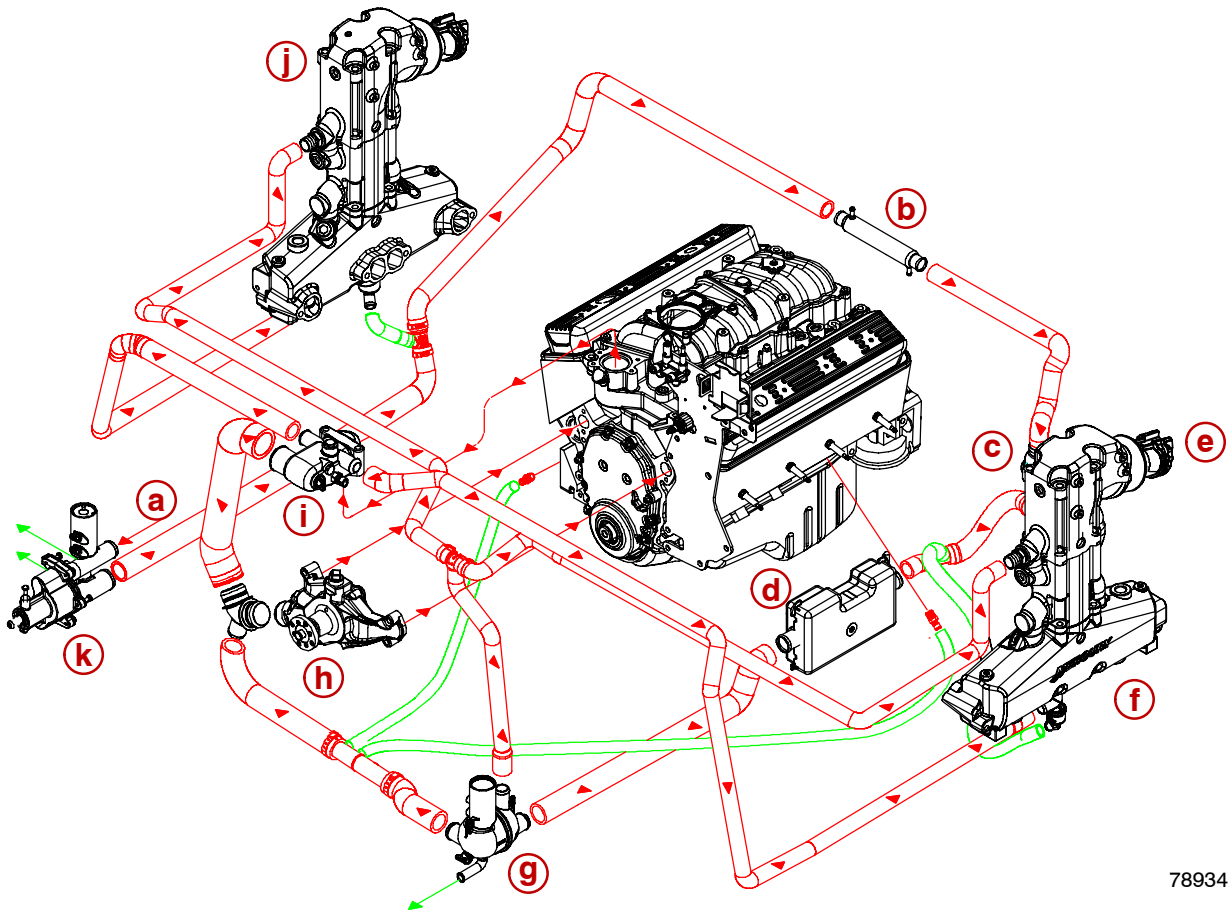


78926

a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump
l - Heat exchanger

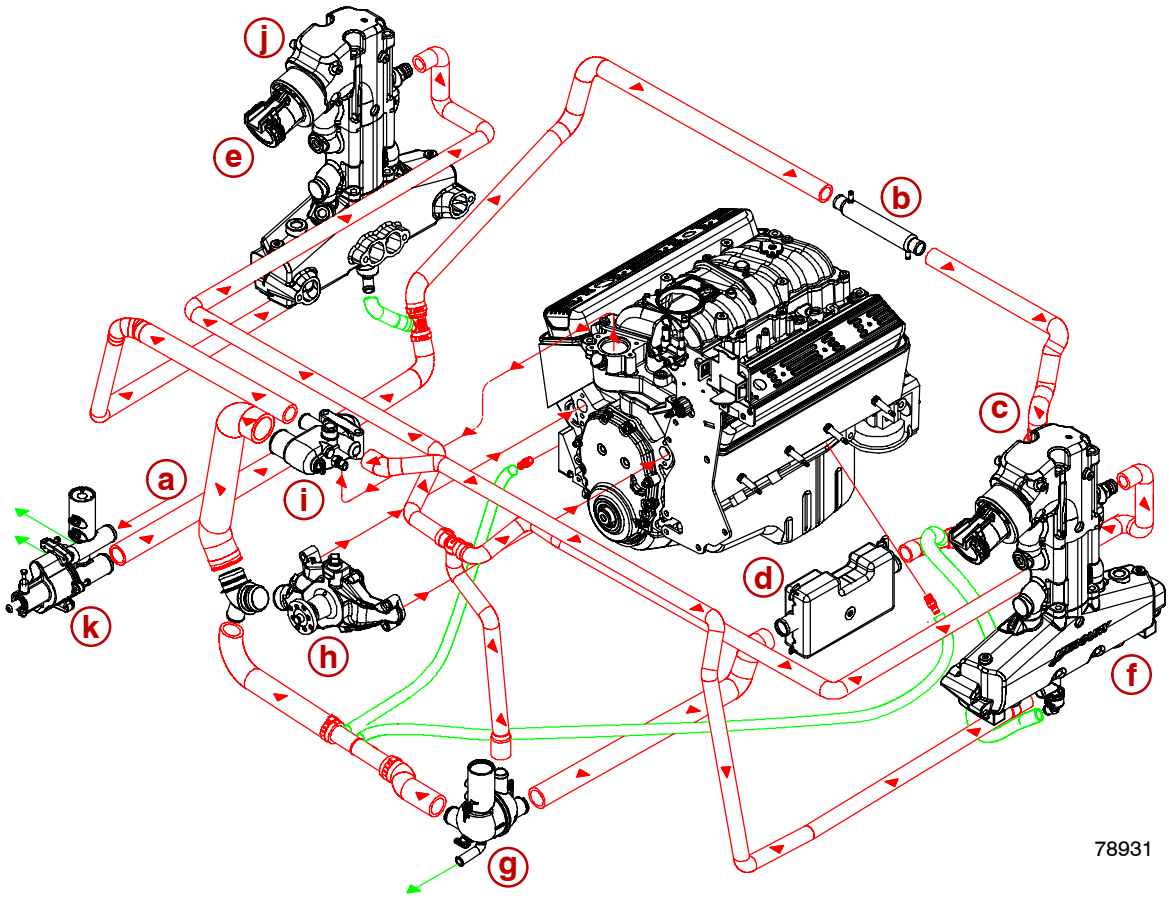
1 - Seawater
2 - Ethylene glycol mix

Seawater Cooled Bravo And Inline Inboard Models With Warm Risers



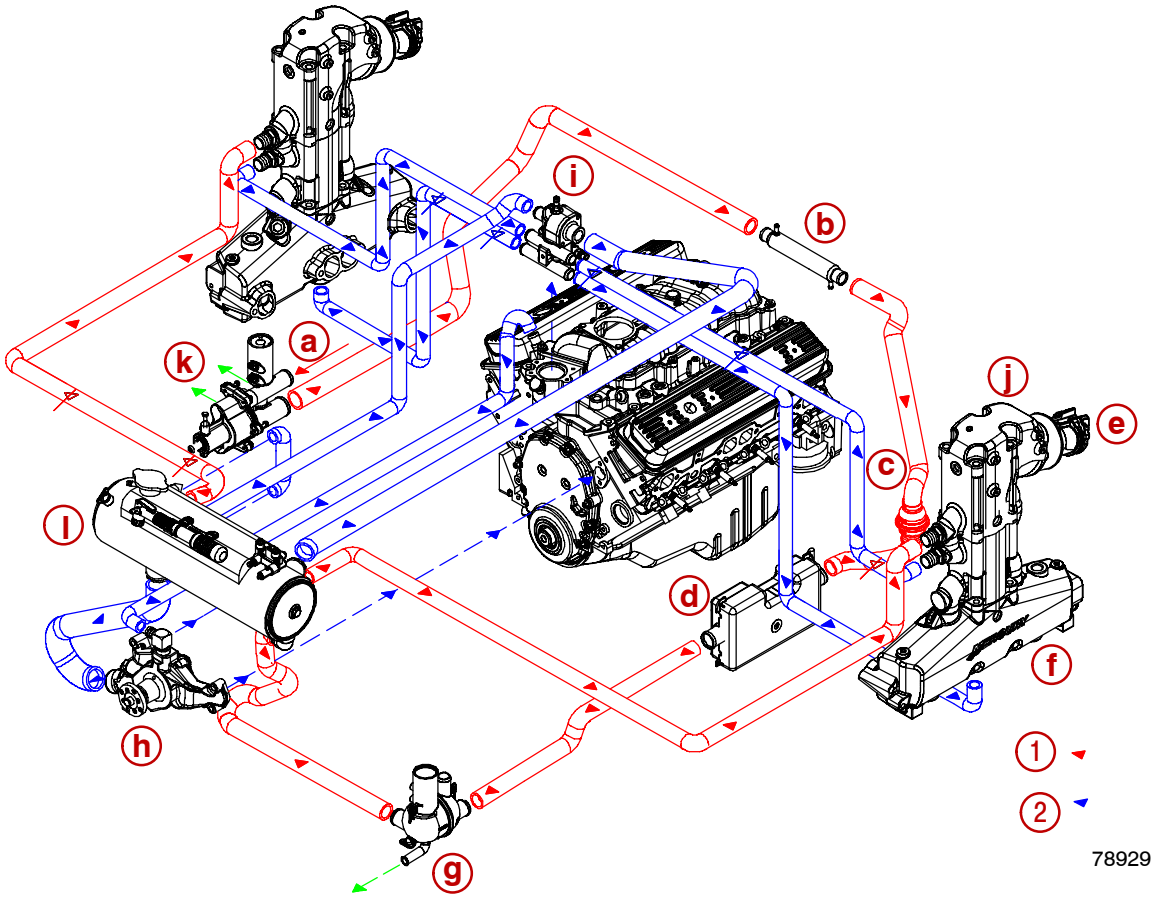
a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - 14 degree exhaust elbow shown (7 degree exhaust elbow similar)
k - Seawater pump

Seawater Cooled V-drive Inboard Models With Warm Risers



a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump

Closed Cooled Bravo And Inline Inboard Models With Warm Risers

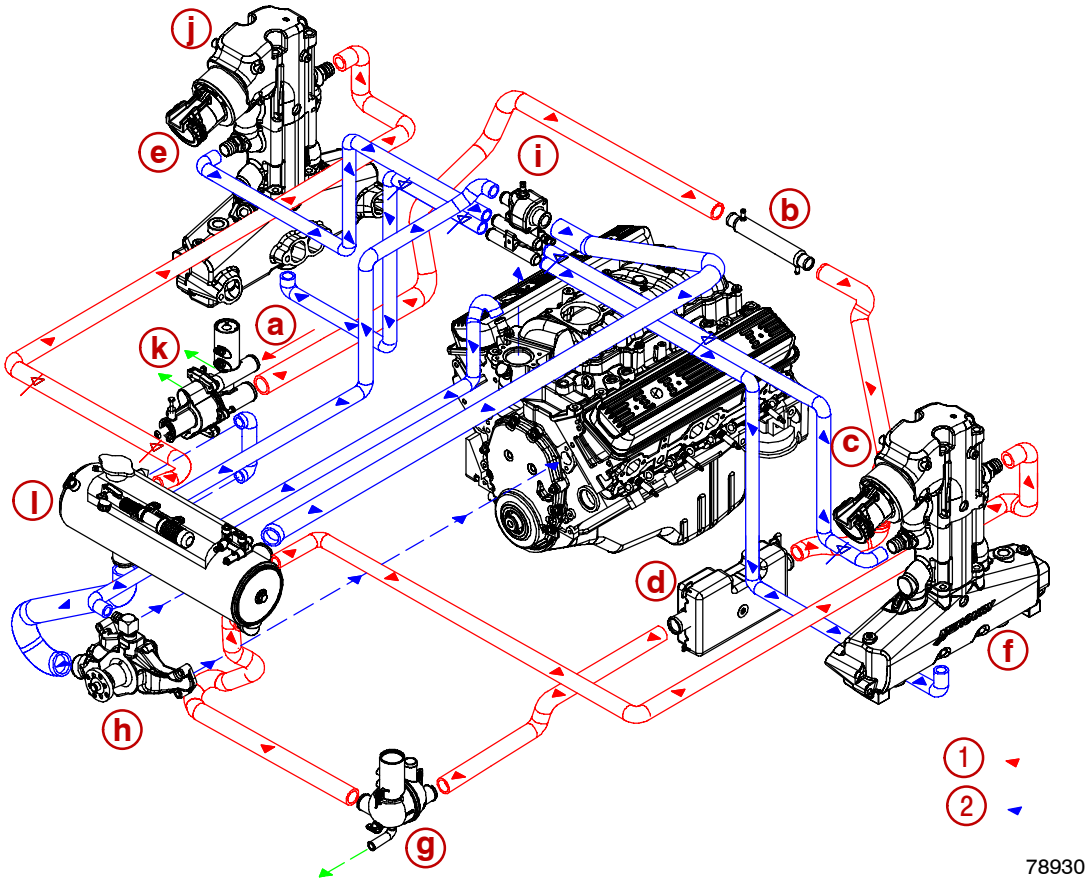


a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing

1 - Seawater
2 - Ethylene glycol mix

h - Water circulating pump
i - Thermostat housing
j - 14 degree exhaust elbow shown (7 degree exhaust elbow similar)
k - Seawater pump
l - Heat exchanger

Closed Cooled V-drive Inboard Models With Warm Risers



a - Seawater inlet
b - Transmission cooler
c - Check valve
d - Fuel cooler
e - Exhaust and seawater outlet
f - Exhaust manifold
g - Distribution housing
h - Water circulating pump
i - Thermostat housing
j - Exhaust elbow
k - Seawater pump
l - Heat exchanger

1 - Seawater
2 - Ethylene glycol mix